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The
House Painter

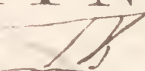
Chas Nicholson

29. EL



HOUSE PAINTER;

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DECORATOR'S COMPANION:



A COMPLETE TREATISE

A complete Treatise

ON THE

ORIGIN OF COLOUR, THE LAWS OF HARMONIOUS COLOURING, THE
MANUFACTURE OF PIGMENTS, OILS, AND VARNISHES;

AND THE ART OF

and the art

HOUSE PAINTING, GRAINING, AND MARBLING.

TO WHICH IS ADDED,

A HISTORY OF THE ART IN ALL AGES

BY W. MULLINGAR HIGGINS, ESQ.
ARCHITECT,

Formerly Professor of Mechanical and Experimental Philosophy at Guy's Hospital.

LONDON:

THOMAS KELLY, PATERNOSTER ROW,

AND SOLD BY ALL BOOKSELLERS.

MDCCCXLI.

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LONDON:
JOHN RIDER, PRINTER,
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Mr. William Nicholson.
Dunglass. Kingston.

P R E F A C E.

AMONG all ranks of society there is a strong desire for the adoption of an elegant and suitable style of internal domestic decoration. But although this feeling is now so general, House Painting, upon which all varieties of decoration depend, holds no higher place in the public estimation than that of the meanest of the mechanical arts. We are far from wishing to depreciate this important profession; but we are, at the same time, compelled to admit that it deserves no higher character, as practised by the majority of those persons who have adopted it as a means of employment. This fact, how humiliating soever it may be, will be admitted by all who are engaged in the art of building, and, if we are not greatly mistaken, by the house-painters themselves. A consciousness of the low state of the art is a foundation for the introduction of a better taste, which must be established upon a more extensive acquaintance with the principles on which it depends. There is not, however, in the English language, and we believe in no other, a work which can be called a complete treatise on the subject; and it was under the hope of supplying this deficiency that the present work was undertaken.

The work as it is now presented to the public, contains a general description of all those branches of knowledge which seem necessary for an accurate acquaintance with, and practice of, House Painting; a term which we do not confine to the mere circumstance of covering the surface of wood or plaster with paint, but extend to the choice of suitable and harmonious colours, and the decoration of apartments in the highest style of art.

The subject naturally divides itself into three parts:—first, the origin of colours, and the circumstances under which they impress us with pleasing emotions; secondly, the manufacture of colours, varnishes, and tools employed

by the house-painter; thirdly, the mechanical processes in house-painting, and the imitation of woods and marbles.

The reader may, perhaps, at the commencement of the work, imagine that we have entered with too much minuteness into the philosophy of colour, and the circumstances under which it is produced; but we feel convinced that it is only by the habit of philosophical investigation that the painter can arrive at excellence in his art. Many persons who are in the daily habit of using pigments for the sake of colour, are quite unable to give a philosophical reason for the effect produced; and to them the simple explanations we have offered will, it is hoped, be interesting and valuable. The origin of colour in its influence upon the human mind, and the principles of harmonious combination, are subjects of equal interest and importance, and have been discussed as essential branches of knowledge to the house-painter.

The manufacture of pigments, varnishes, and other articles employed by the painter, has been described in familiar terms, separated, as much as possible, from the technicalities of chemical science. An attempt has also been made to point out the relative values of different pigments, and the means by which the adulterations can be detected.

Ample directions have been given in the third part of the work to instruct the student in the mechanical operations of his profession; and we have entered with some minuteness into a description of the modes of imitating woods and marbles. The work closes with a history of house-painting, as practised by the nations of antiquity and in modern ages.

The volume is illustrated with specimens of graining and marbling, all of which are the *Productions of the Brush*, and may be safely studied as admirable specimens of art, and excellent imitations of the woods and marbles they are intended to represent.

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INTRODUCTORY CHAPTER.

HOUSE PAINTING is of great antiquity, being, in all probability, nearly coeval with the art of building. The first houses erected by men, when they began to till the soil and associate together for mutual protection and support, were formed of wood. These were rude in construction, and merely intended as temporary shelters from the tropical storms and fierce heats of the country their builders inhabited, being at the same time a protection from prowling beasts of prey, and the inquisitive impertinence of their fellow-men. In fact, these dwellings formed the homes of the aborigines of the human race; and being rude in their construction, as the first efforts of mind towards a state of social life must necessarily have been, their permanence was a matter of small importance. At a very early period, however, in the history of nations, the use of burnt clay or bricks was discovered, and the means of uniting them together by a "slime," or mortar. The durability of these materials may be supposed to have induced a greater care in the arrangement and construction of the houses of the settlers; while the absolute wants and conveniences of a state of life requiring a continued residence upon a particular spot, for the purposes of agriculture or trade, being better known, would be suitably provided for. As the use of wood could not be rejected altogether in the art of building, the perishable nature of the material demanded some artificial means of preservation, which was found in the application of colour. The circumstances which led to the use of certain mineral substances as colours are not recorded, even in fables, and we will not therefore attempt to trace the probable discovery, by following that course of reasoning which may be supposed to have arisen in the mind of an intelligent individual; although it is by no means improbable that the manufacture of an artificial stone capable of resisting the effects of the atmosphere, and not liable to a rapid decomposition, may have

suggested the application of earth to the surface of wood, as a means of preservation. But whatever observation or discovery led to the use of colours, there is abundant recorded evidence of their application in house painting, among the earliest nations of mankind.

That which was commenced as a matter of necessity was afterwards universally adopted as a source of refined pleasure. Earths of different colours were found, and means were discovered of so applying them to the surfaces of different substances, as to represent forms in a manner highly pleasing to the eye; the mere presence of colours, arranged in an order similar to that observed in nature, being a source of mental gratification. New modes of applying these colours were from time to time invented, and other colours were discovered by the studious inquiries of those who devoted their attention to the improvement of the art, and a fertile source of amusement and instruction was thus opened to the human mind. The art commenced in the necessity of preserving wood, one of the most useful substances in nature to the builder and mechanist, from the many sources of decay to which it is exposed; but it soon expanded under the control of man's inventive powers, and, in a comparatively short period, called into active operation the latent energies and capacities of imitation, by which the human race has been hastened from one state of civilization to another, till at last it has been blessed with all the social and mental enjoyments of which an intellectual nature is capable.

In all nations possessing a distinctive architecture, colour has been applied, in house painting, not only to materials which would otherwise be liable to perish, from the action of the atmosphere and other sources of decomposition, but also to those which are used in situations where chemical decomposition is not easily effected. There are, however, but few substances which are not rendered more durable by protection from the atmosphere, which is at once secured by a coating of paint. Among the improvements introduced in the art of building at an early age, the use of plaster for the ceilings of walls and apartments, may be particularly mentioned. But this substance, although admirably adapted for the purpose to which it is applied, has the property of absorbing moisture, so that it is unfit for exposure to a humid atmosphere, unless it be made in some way impervious to the aqueous particles with which the air is loaded. By the application of colour the plaster is protected; an unwholesome atmosphere, occasioned by the alternate processes of absorption and vaporisation, is prevented, and the material itself is

rendered more durable. The use of colour in this manner, at once suggests the propriety of employing it as a means of decoration, which has been done successfully both in ancient and in modern times.

From these remarks it will appear that house painting may be considered both as a mechanical and a fine art, but in our own day it has in the latter sense sunk in public estimation, from a want of knowledge and taste too evident among those by whom it is practised as a profession. The opinions which are entertained of any pursuit, by a community, may be generally traced to the estimate formed by those who regard it as their employment; and this is strictly true in reference to house painting, for it has been degraded to the meanest of the mechanical arts by the painters themselves. From this condition it can be raised only by the diffusion of knowledge among the artisans, and by giving to them a higher standard of excellence than that they have adopted. Under the hope of aiding the accomplishment of these desirable objects, this volume has been written. No subject has hitherto been so much neglected by the profession to which the author has the honour to belong, for there is not a complete work in the English language, or probably in any other, upon the subject. A few essays upon the manufacture of colours have been written, and some excellent publications on the harmony of colours have recently appeared in France, as well as in this country; but no attempt has yet been made to furnish the house painter with a systematic treatise on his art.

The author of the following pages is not unconscious of the difficulty of the task he has undertaken, but still hopes that his work will be found less imperfect than any other which has hitherto appeared. He has attempted to collect all the facts, both in theory and practice, which are necessary to the student; and so to arrange them, that the reader may be led from one branch of the subject to another, without impediment or confusion. In the first portion of the work, the production of colour has been explained as arising from the decomposition of light. The origin of harmony in colours has been then briefly stated, and the importance of the subject has been urged, as it must be the foundation of every arrangement suited to please the eye, by the production of variety without gaudiness or discord. The errors into which the house painter is liable to fall have also been mentioned, and the means by which those errors are to be corrected have been pointed out.

The description of the manufacture of colours, oils, varnishes, and even the tools

employed by the house painter, forms the second part of the work. An attempt has been made to convey useful information to the reader on these subjects in so simple a form, that those persons who are ignorant of the science of chemistry may follow the descriptions without difficulty, and even acquire an amount of information on that science which will greatly facilitate the study of other branches of the art of building in which it is also required. All the works hitherto published on the manufacture of colours, are utterly useless to the general reader, being for the most part collections of formulæ; and the greater number have been so carelessly written by their authors, or so disfigured by editors, as to be unworthy of confidence. These errors, either in theory or practice, have been pointed out and corrected, and the whole subject has been so simplified, that the student will no longer find himself perplexed with empirical assertions, and dogmas having no foundation in experimental science.

The theory of colour, and the manufacture of pigments and vehicles being fully illustrated, the reader will be prepared for the study of the mechanical processes employed by the house painter, together with the modes of graining, marbling, and varnishing. In the remarks made upon these subjects, the young artist will find directions to guide him under all circumstances, and the most approved modes of practice. It has not been thought sufficient to state what is done, but to explain why it is done; and to point out, where necessary, the defects of present modes of operation, when adopted without a suitable foundation in the principles of nature and science.

A history of the art of house painting from the earliest period to the present time, has been added; and the work closes with a few remarks upon the manner in which the house-painter's work is valued.

The illustrations, which have been prepared under the immediate inspection of the author, are of a novel character, but peculiarly interesting and useful. They are chiefly specimens of graining and marbling, and have been executed by a talented artist, who has long devoted his time and energies to this branch of his profession. They are not impressions from blocks, but have been painted expressly for the work, so that each example is the actual production of the brush, and may be safely studied as a correct imitation of the wood or stone it is intended to represent.

CHAPTER I.

THE PHILOSOPHY OF COLOUR.

As it is our intention to give a full description of the nature of colours, and their use by the house painter, so as to satisfy the inquiries of our readers upon all subjects connected with them, it will be desirable to commence with a brief account of the origin of colour, and to explain those natural laws, or principles, upon which it depends. This appears to be the more necessary, as many persons still entertain the erroneous opinion that colour is an inherent property of bodies, and as necessary to their existence as gravitation or form. This, however, is by no means the case, for colour is but an accidental quality, entirely dependent on physical conditions; and the possession of one colour in preference to all others, is no more a necessary property of one kind, species, or variety of matter, than a certain degree of hardness, which, as every one is aware, is regulated in most cases by its temperature. To prove this statement it will be necessary to explain those experiments by which scientific men have ascertained the composition of light, and the influence of bodies upon it, in the production of colour.

The natural light which we enjoy upon the surface of the earth, and by which we are able to see the objects around us, is white. It is in conversational phrase spoken of as proceeding from the sun, and was once considered an emanation from that body; but this theory has been abandoned by modern philosophers, although it is still acknowledged that light, in its active qualities, is dependent on the sun, for which cause it is called solar light. If a ray of this light be allowed to pass into a darkened room through a small opening in a window shutter, and be received on a suitable screen, it will appear as a white spot; and yet if it illuminate an apartment, every object will have a particular colour, by which, in connexion with other properties, that object is under ordinary circumstances known. The question then at once arises—To what cause can the colour of substances be traced? The labours of Sir Isaac Newton, and those who have followed him in the experimental investigation of light, supply a satisfactory answer; but before

we can with propriety refer to these, a few introductory remarks will be necessary, for the information of those who have not made themselves acquainted with the elementary principles of that most wonderful of all the subjects of modern experiment, the science of optics.

Light moves in right lines when traversing an uniform medium, but when it passes from one medium to another, having different densities, it is bent out of its straight course; or, to use the phraseology of science, is refracted. It is difficult to fix upon any natural transparent substance which can be said to have, throughout its entire mass, an uniform density. The atmosphere by which the earth is surrounded is not an uniform medium; for, as is well known, its density decreases from the surface of the planet to the very limit of its existence wherever that limit may be, and hence the progress of light through it is not in right lines. The waters which rest in the hollows of the earth, and form rivers, lakes, seas, and oceans, more nearly approximate to an uniformity of density; but we cannot discover, such is the condition of natural substances, any state of matter in which light can have a long-continued progress in right lines. Refraction is a phenomenon constantly observed as attending the passage of light from one medium into another, and is the more striking according to the difference in density. Every one who has not been altogether inattentive to natural phenomena, must have observed the broken appearance of all objects which are placed in a vertical position, being partly in air and partly in water, when viewed on the banks of a river, or by the sea-shore. This appearance is so striking that an observer may be deceived by it, but it is readily explained by the doctrine of refraction.

To make this subject more familiar to the reader, a simple but interesting experiment may be mentioned. Place a basin upon a table, and at the bottom of the vessel fix a coin, a shilling for example. Then walk from the table, keeping the eye fixed on the coin until it can no longer be seen, the edge of the basin intercepting the sight. In this position remain with the eye fixed, keeping the head in the same posture, neither leaning forward nor backward. Let some person near the table then pour water into the vessel, and the shilling will again appear; for the ray of light by which it is illuminated, is broken or refracted, causing the coin to have a greater apparent elevation than it had when air was the medium. The stars and other celestial objects also, appear to have a greater elevation than they really possess, on account of the refraction of light by the atmosphere, and the perception of every object in that direction in which the ray from the object strikes the eye.

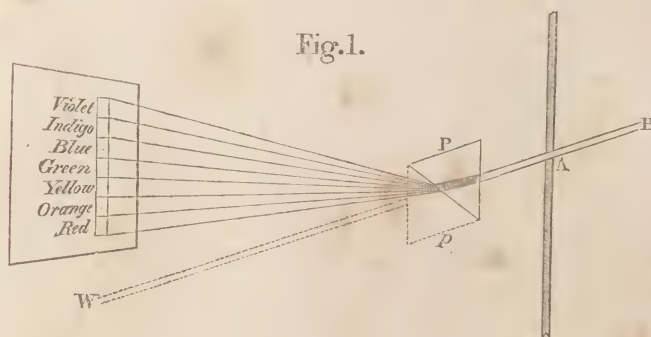
Upon this subject it would be easy to enlarge by a more detailed explanation of the facts just mentioned, and the enumeration of the many natural appearances and physical deceptions occasioned by the refraction of light; but sufficient has perhaps been said to explain the fact that light is bent out of a straight line by the interception of a transparent substance, having a different density to that of the medium in which it before moved; and to add further illustration would expose us to censure for deviating from the main object of this work.

Glass is a transparent substance, or, in other words, one through which light can pass; but, as its density is much greater than that of atmospheric air, light is always refracted in its passage from one of these media to the other. The path of a ray of light, however, through glass, varies according to the form of the surface, the light being in some cases collected in a point, when it is said to be converged, and in others diffused. In the year 1666, Newton, who may be distinguished, without disparaging the genius or labours of others, as *The Philosopher*, applied himself, to use his own words, "to the grinding of optic glasses of other figures than spherical;" and among various forms obtained a triangular glass prism, through which he passed a ray of light. In using glasses of a convex shape a spot of white light was thrown upon a prepared screen, at a greater or less distance, but with the prism an oblong figure composed of seven different colours was obtained. The description which Sir Isaac gave of his experiments to the secretary of the Royal Society, is too interesting to be passed over without an extract. "Having darkened my chamber," he says, "and made a small hole in my window-shutters to let in a convenient quantity of the sun's light, I placed my prism at its entrance, that it might thereby be refracted to the opposite wall. It was at first a very pleasing diversion to view the vivid and intense colours produced thereby, but after a while applying myself to consider them more circumspectly, I was surprised to see them in an oblong form, which, according to the received laws of refraction, I expected would have been circular. They were terminated at the sides by straight lines, but at the ends the decay of light was so gradual that it was difficult to determine justly what was their figure, yet they seemed semi-circular." The illustrious author then proceeded to inquire into the origin of the form of the coloured spectrum produced by the glass prism; and, after many experiments, discovered that the several colours or rays of which the beam of white light was composed had different degrees of refraction, so that one was more bent than another, which was, in his opinion, the cause of their being separated.

From these remarks it will appear that the white light of the sun is not a

simple, or, to use a scientific term, a homogeneous substance, but consists of differently coloured rays, which, although intimately combined in nature, may be separated by experiment. This may be at any time done by the aid of a glass prism, when the sun is shining brightly; but it is best accomplished by admitting a beam of bright light into a darkened apartment. The following description will assist the reader in performing the experiment.

A beam of light, B, is supposed to pass through an aperture, A, in a window shutter, and if no substance intervened to turn it from its path, it would move in a rectilinear direction, and fall upon the opposite wall or screen as a bright white spot. But let a triangular glass prism, P, be so placed as to intercept the light, care being taken to present it in such a manner that the light may emerge from one surface at the same angle as it enters the opposite. The first thing we observe is, that the direction of the light is changed, for it is refracted; but at



the same time a more remarkable phenomenon is witnessed, for instead of the bright white spot, a series of vivid colours are formed, commonly known as the solar or prismatic spectrum. This oblong image always consists of the same

colours, seven in number, and ranged in the same order, red, orange, yellow, green, blue, indigo, and violet. Hence then, it may be supposed, white light is a compound of these coloured rays, a fact capable of proof by a diversity of experiments. Concerning the deductions to be drawn from the discovery, and the influence of the fact upon the progress of optical science, we have not here an opportunity of speaking, as the mere fact is all that is necessary to be known by the reader for the understanding of the questions to which his attention will be presently directed.

Newton having succeeded in the decomposition of white light, next attempted its composition by the union of the several coloured rays. This may be effected in various ways, but it will be sufficient to mention one. Having performed the experiment represented in figure 1, take a second prism, P, formed of the same kind of glass, and with the same angles, and place it against

the former one in an opposite position, so that the two may make a transparent medium of a rectangular shape, the opposite surfaces being parallel as shown in the diagram. The white light which is decomposed by one prism, P, will now be re-composed by the other, and a spot of white light, W, will be formed; - for the refraction on one surface will be corrected by the refraction on the other. This experiment will be more interesting and illustrative if a thick plate of oil of cassia be placed between the two parallel surfaces of glass, for the spectrum formed by the first prism will then be distinctly visible, and the re-combination of the rays may be observed.

There are also other methods of proving that the coloured rays, in certain proportions, produce white light. Thus, for example, if seven powders having the colours of the prismatic spectrum, and in quantities proportional to the coloured spaces, be mixed together, they will produce a white powder, or more properly, a greyish white, as the prismatic colours cannot be accurately obtained. For the same reason a circular disc, if painted to imitate the colours and proportions of the solar spectrum, will appear quite white when put into a state of rapid rotation.

Having proved, both by analysis and synthesis, that white light consists of seven differently coloured rays united in certain proportions, Newton next endeavoured to ascertain whether these rays were homogeneous, or compounded of rays more simple than themselves. For this purpose he made such an arrangement, that he could submit either of the coloured rays to the action of a second prism, and by experimenting upon them separately, in the same manner as he had previously done upon white light, he found that they were incapable of decomposition, and consequently came to the conclusion that they were primitive or homogeneous rays. The same experiments have been made by other philosophers, with the same results, but they have, notwithstanding, formed a different opinion of the constitution of colours in the prismatic spectrum. Although it is quite true that none of these colours can be decomposed in the same manner as white light, it does not follow that they must be homogeneous, as was at first supposed. Indeed some of the most eminent philosophers and artists have indulged a contrary opinion, and that before any scientific proof of the accuracy of such a supposition had been given, but merely upon the evidence of the painter, who asserted that all colours could be produced from three. Those who had been accustomed to the investigation of nature well knew, that in the formation of matter, and in the establishment of the laws by which it is governed, the Creator had adopted means the most simple, for the accomplishment of His ulterior purposes; as though He desired to

prompt the inquiries of His intelligent creatures, by adapting physical existence to their powers of investigation. Knowing that in the formation of natural agencies there was no waste of creative power, scientific men assumed, that as three colours were sufficient to produce all others, there could not be more than three primitive colours in the solar spectrum. Mayer, in his Essay "*De Affinitate Colorum*," maintains that red, yellow, and blue, are the primitive colours, and that all others are formed by their union, in different proportions, the white being a neutral mixture of all the rays, and black a negation of light. But the first proof of the existence of but three primitive colours, was probably obtained by Mr. Hay of Edinburgh, whose work on the laws of Harmonious Colouring, is worthy of the highest respect, not less for the perspicuous and unaffected style in which it is written, than for the valuable information it contains. Of this writer, who is practically acquainted with the subject we are attempting to explain, we feel bound to take public notice, for the labours of such men have a more than ordinary interest to those who are engaged in similar pursuits.

"After having tried every colour in succession," says Mr. Hay, speaking of the prismatic rays, "and finding that none of them could be separated into two, I next made a hole in the first screen in the centre of the blue of the spectrum, and another in that of the red. I had, thereby, a spot of each of these colours upon a second screen. I then, by means of another prism, directed the blue spot to the same part of the second screen on which the red appeared, where they united, and produced a violet as pure and intense as that upon the spectrum. I did the same with the blue and yellow, and produced the prismatic green; as also with the red and yellow, and orange was the result. I tried in the same manner, to mix a simple with what I thought a compound colour, but they did not unite, for no sooner was the red spot thrown upon the green, than it disappeared."

By these experiments we are undoubtedly led to the conclusion that the solar spectrum consists of three primitive rays, red, yellow, and blue, by the union of which in different proportions, the intervening colours are formed, as by the complete combination of the three, white light is produced. Dr. Brewster, whose name is intimately associated with every inquiry in optical science, has given additional proof of the fact already stated by an examination of the spectra formed by different substances.

The attention of the reader has hitherto been confined to the decomposition of light by refraction, but a few remarks must now be made upon the production of the same effect by absorption. When light falls upon any substance, it is either refracted, reflected, or absorbed. It has been ascertained by experiment, that the

amount of reflected and refracted light from any transparent body, is less than the amount of light which falls upon it, a certain portion being in some way lost. One cause of this loss is, without doubt, the irregular reflection which scatters a portion of the incident light, but the more important cause is the absorption of some rays in a greater or less degree, by the particles of the transparent body.

A body is said to be transparent when the rays of light pass through it, and it is more or less transparent according to its power of transmitting light without decomposition, or according to the smallness of the impediment thrown in the way by its physical structure. No substance is perfectly transparent, for light has always a diminished intensity when it has traversed a medium which does in small spaces decompose it, but the greater the extent of the medium, the greater will be the absorption. When light falls upon a body of water, it enters, for the medium is transparent, but it is scarcely probable that a ray ever reached the depths of the ocean. It is a well-known fact, that more stars can be seen on the summit of a high mountain, than on the plains beneath it, which can only be accounted for by supposing their light to be absorbed by the lower strata of the atmosphere. Light is also lost in passing through the lenses of a telescope, as is well known to those who have paid any attention to the construction of that instrument. From these facts it must appear that the most transparent substances in nature are not possessed of this property in perfection; and on the other hand we may state that it is not altogether wanting in any body, how dense soever it may be. Gold may be beaten so thin as to become transparent, and other substances which are generally supposed to be impervious to light, do admit its entrance to a certain depth beneath their surfaces. Every substance may therefore be said to absorb light in some degree, although certain varieties of matter, from a peculiar physical constitution, cannot, in the usual acceptation of the term, be called transparent.

Substances may be transparent without being so in an equal degree to all the coloured rays, so that white light is decomposed by a greater absorption of one coloured ray than of the others, a fact which accounts for the colours presented by certain media when observed by transmitted light. Now, as all transparent substances have a preference, if we may so speak, for one colour, it follows as a consequence that white light is decomposed by absorption, and the thicker the medium, the greater the amount of absorption. This also accounts for the change of colour presented by certain media when transmitting light varying with the thickness of the transparent body. Dr. Brewster in illustrating this subject in his *Treatise on Optics*, has taken as an example the phenomena observed when looking through a piece of that blue glass generally used for finger glasses.

and other purposes in which utility and ornament are combined. The blue of this substance is not, as he says, a simple homogeneous colour like the blue of the spectrum, but is a compound of all the rays not absorbed by the glass; and the colours which the glass has absorbed, are those which the blue wants of white light, or which, when mixed with this light, would form white light. In order to determine what these colours are, first look at a circular aperture in the shutter of a darkened room through a prism, and the spectrum already described will be seen. Let the blue glass be now interposed between the eye and the prism, and a remarkable spectrum will be observed,—one which is deficient in a certain number of the differently coloured rays. A particular thickness absorbs the middle of the red space, the whole of the orange, a great part of the green, a considerable part of the blue, a little of the indigo, and very little of the violet. The yellow space, which has not been much absorbed, has increased in breadth. It occupies part of the space formerly covered by the orange on one side, and part of the space formerly covered by the green on the other. Hence it follows, that the blue glass has absorbed the red light, which, when mixed with the yellow light, constituted orange; and also the blue light, which, when mixed with the yellow, constituted the part of the green space next to the yellow. We have, therefore, by absorption, decomposed green light into yellow and blue, and orange light into yellow and red, and it consequently follows, that the orange and green rays of the spectrum, though they cannot be decomposed by prismatic refraction, can be decomposed by absorption, and actually consist of two different colours possessing the same degree of refrangibility."

From what has been said, the reader will be able to understand the composition of white light, and the means by which it may be decomposed, not only into the seven coloured rays of the prismatic spectrum, but also into the three primitive colours, which, by their admixture, form the others. It now only remains for us to explain in this chapter, the reason why bodies have colour when viewed by the aid of white light.

That colour is not an inherent property of matter, is proved by the fact, that whatever may be the colour which naturally belongs to a substance in white light, it will assume the hue of any of the prismatic rays in which it may be placed, although that one will be most vivid which approaches nearest to the colour of the substance in white light. Sir John Herschel, in the illustration of this fact, takes vermilion as an example, which substance will have the colour of any part of the spectrum in which it may be placed, but while it presents the most vivid red when placed in the red rays, it has a dark and dull appearance in the green, from its inaptitude

to reflect the green light, and in the blue, indigo, and violet, it presents a still more imperfect colour. On the other hand, a piece of Prussian blue has an extraordinary richness and depth of colour in the indigo rays, but has little power of reflecting the red.

The colour of a body in white light depends on the colour of the rays which it reflects. When light falls upon any substance, it is either chiefly refracted or reflected; but in both cases a portion is generally absorbed. It is by the reflected light that the body is viewed, and according to the colour of the reflected rays will be that of the substance itself. If all the rays are equally reflected, it will be white; if they are all equally absorbed, and no reflection attends the process, it will appear black. This simple principle affords a philosophical explanation of the origin of colour in bodies, but no explanation can be given of the property or arrangement of matter, by which rays of one colour are absorbed, and those of another reflected.

As it is our intention to explain, in a subsequent chapter, the various circumstances under which colour is produced, a few general remarks concerning the nature of light, and the phenomena it presents, will, perhaps, be interesting to those who are for the first time brought to the consideration of this important branch of knowledge. Nor is this subject unconnected with the object of our work, which is, to teach those facts relating to colour necessary for the practice of house decoration; for colour, in what manner soever it may be produced, is to be traced to some modified condition of its agent, light.

The question, "What is light?" has been long attentively considered by philosophers, and every reply has been carefully, if not candidly investigated. Men have thus been led to the discovery of many important facts; but an unanimity of opinion has not, even in the present day, been attained.

The great similarity of the effects of light and sound upon the organs which they severally influence, induced many of the philosophers of the last two centuries to believe that their production may be explained by similar hypotheses. Now it has been long known that sound is produced by undulations excited in the sounding body, and propagated by the air as a conducting medium; and it has been supposed that light is occasioned by undulations excited in an ether of extreme rarity. These undulations, according to Descartes, are produced by the action of the sun on the medium, and they, acting upon the eye, instantaneously cause that sensation which is called light. A similar hypothesis was proposed by Aristotle; for he supposed light to be occasioned by the action of a subtile, pure, and homogeneous matter or ether which the sun put in motion.

This theory was adopted by Euler, one of the most celebrated mathematicians of the day, and is now almost universally received by opticians as offering a better explanation of facts than any other, although it cannot be denied by its warmest supporters, that, under many circumstances, there are great difficulties in its application.

Sir Isaac Newton rejected this theory, and maintained that light was not the result of undulations produced in a fluid medium, but that it proceeded from a vast number of exceedingly small particles thrown out by a repulsive force from every luminous body, and that these particles move with an amazing velocity in right lines. That the rays of light move in straight lines is proved by the circumstance, that if an opaque body pass directly between the eye and a luminous point, the light is hidden or eclipsed; whereas, in any other position, the progress of the light is not impeded. There are three different circumstances under which light may be deflected from its course, and these are denominated refraction, reflexion, and inflexion; and in all these cases, colour is frequently produced. Light, however, may undergo another process, called absorption or extinction, to which allusion has been already made.

That the particles of light are exceedingly small is evident; for through an aperture one-hundredth part of an inch in diameter, nearly the whole hemisphere may be seen, and particles of light reflected from every portion of an extensive prospect pass through that small aperture, and form an image of it upon the retina of the eye. If another reason were required for the opinion that the particles of light are exceedingly small, we might urge the fact that they cross each other without undergoing the slightest alteration, a fact which is still more astonishing when we recollect their almost instantaneous progress.

The ancient philosophers maintained that the progress of light was instantaneous. This is expressly stated by Aristotle; and Chrysippus the Stoic, who was the successor of Zeno, taught the same doctrine, and illustrated the assumed fact, by the motion of a long rod, which, he said, being moved at one end, is at the same instant of time pushed forward at the other.

That light moves with an amazing velocity has been admitted by all modern philosophers; but we are indebted to M. Rømer, a native of Arhusen in Jutland, for the absolute measurement of its velocity, to which he was led by some observations on the satellites of Jupiter. When the earth is between Jupiter and the sun, an eclipse of the satellites of that planet is seen eight minutes thirteen seconds earlier than the calculated period. When the sun is between the earth and Jupiter, an eclipse happens eight minutes thirteen seconds later than the

calculated time. These variations can only be accounted for by assuming the progressive motion of light, and that light requires sixteen minutes twenty-six seconds to perform its passage across the orbit of the earth, which is 190,000,000 miles. Light is, therefore, said to move with a velocity of 200,000 miles in a second.

The importance of this subject leads us to notice a theory proposed in youth, to which we are still inclined to give some credence, and it may be stated in almost the same words in which it was first announced. The particles of light which are commonly supposed to be in themselves lucid, are not so in fact; and this will appear evident by considering that the effect is produced in the organ of vision. The effect is mistaken for the cause. The particles of light may be of an opaque and dark nature, and yet excite the organ of vision and cause a perception of light. Every one is aware that the sensation may be at any time produced by pressing with the finger upon the eye, which will produce not only light, but colour, a fact which leads to the conclusion, that whenever the visual organ is sufficiently irritated, the sensation of light is produced.

Since this work was prepared for the press, Mr. Eastlake has published a translation of Goethe's valuable "Theory of Colour," of which we are now able to avail ourselves only in part. The theory adopted by this extraordinary man, is not likely to obtain general credence, but is at least worthy of notice. "The eye," he says, "sees no form, inasmuch as light, shade, and colour together, constitute that which to our vision distinguishes object from object, and the parts of an object from each other. From these three, light, shade, and colour, we construct the visible world, and thus, at the same time, make painting possible, an art which has the power of producing on a flat surface, a much more perfect visible world, than the actual one can be.

"The eye may be said to owe its existence to light, which calls forth, as it were, a sense that is akin to itself; the eye, in short, is formed with reference to light, and to be fit for the action of light; the light it contains corresponding with the light without.

"This immediate affinity between light and the eye, will be denied by none; to consider them as identical in substance, is less easy to comprehend. It will be more intelligible to assert that a dormant light resides in the eye, and that it may be excited by the slightest cause from within or from without. In darkness, we can, by an effort of imagination, call up the brightest images; in dreams, objects appear to us as in broad daylight; awake, the slightest external action of light is perceptible, and if the organ suffers an actual shock, light and colours spring forth. Here, however, those who are wont to proceed according to a certain method, may

perhaps observe that as yet we have not decidedly explained what colour is. This question, like the definition of light and the eye, we would for the present evade, and would appeal to our inquiry itself, where we have circumstantially shown how colour is produced. We have therefore only to repeat, that colour is a law of nature in relation with the sense of sight. We must assume, too, that every one has this sense, that every one knows the operation of nature on it, for to a blind man it would be impossible to speak of colours.

“That we may not, however, appear too anxious to shun such an explanation, we would re-state what has been said, as follows: colour is an elementary phenomenon in nature, adapted to the sense of vision; a phenomenon, which, like all others, exhibits itself by separation and contrast, by commixture and union, by augmentation and neutralization, by communication and dissolution: under these general terms, its nature may be best comprehended.”

From this brief statement of the theories which have been adopted to account for the origin of light, it will be evident that much uncertainty still exists as to its nature. Of its actions, or the phenomena it presents under varied circumstances, we can speak more confidently, and especially in the production of colour, a branch of optical science which has been minutely investigated by modern philosophers. Solar light, as we have already stated, is white or colourless, but by refraction, absorption, and other means, it is decomposed, and colour appears. But we have many means of obtaining artificial lights, all of which possess more or less colour, and consequently change to a certain extent, the hues of those bodies which they illuminate, a fact of the greatest importance to, though little considered by, those who have the management of domestic decorations. In a subsequent chapter an attempt will be made to explain the circumstances under which colour is produced, and to trace those changes to which light is subject in its action upon bodies. But previous to entering upon this inquiry, it is desirable that the reader should be acquainted with those principles by which the harmonious combination of colours is regulated.

CHAPTER II.

THE HARMONY OF COLOURS.

THE arrangement of colours is, in the estimation of many persons, a mere matter of taste; and to this erroneous opinion may be traced the continuance of a mode of house painting in the highest degree offensive to the educated eye. It is true that the style of decoration is a matter of taste; for while some persons prefer the bright or gaudy, others choose the less attractive and more chaste colours; the effect produced upon the mind being, in all cases, according to the peculiar temperament of the observer. The eye is an organ which excites sensations in the human mind not less powerful than those called into existence by the ear; and the nature of the sensation, in both cases, depends on the mental constitution of the individual. That a certain combination of sounds does not similarly affect all persons, is evident from the preference which is given to different styles of musical composition. One man is most pleased with the solemn majesty of Haydn, another with the scientific and almost mathematical precision of Pixis; a third with the wild genius of Weber; while others, who are unaffected by all these varieties of style, are overpowered by the artless expression of a national ballad. It will not, however, be imagined that no fixed laws regulate the combination of sounds in the production of harmony, because there are all these varieties of taste. It is on the other hand well known, that when certain notes are struck together, or even so as to follow each other, a discord is produced, and a well-tuned, not to say a cultivated ear, is strangely distressed. There are principles, then, by regard to which sounds may be so arranged as to produce harmony; and there are also laws for the arrangement of colours: and as harmonious sounds delight the hearer, so harmonious colours captivate the observer.

In this chapter we shall attempt to explain the principles of harmonious colouring, so as to guide the house painter and decorator in the choice and application of those colours which will so blend one with the other as to

produce a pleasing effect upon an observer. In doing this it will be necessary frequently to refer to the science of music by way of illustration; for it is a remarkable fact, that there is a great similarity between the laws of harmony, as regards sounds and colours. Writers who have preceded us have traced this relationship, and have founded their explanations upon the well-known principles of concord in sounds; nor can we imagine any better mode of instruction than by making one science the key to the other.

But before we proceed any further, it will be necessary to define the terms which must be used. Much error and misconception have frequently been occasioned by not giving a precise meaning to technicalities; and upon examination it has been found, that the contrary statements which have been considered as differences of opinion, or as the result of an ignorance of truth, have arisen from the application of a different meaning to common terms or phrases. To prevent the rise of error and misunderstanding from this cause, we will endeavour to fix a precise meaning to the technical terms of that branch of science which we are about to explain.

There are in music seven distinct notes, but there are only three fundamental sounds, which have been denominated by the letters C, E, and G. So in the chromatic scale, or prismatic spectrum, there are seven distinct colours, but of these only three are primitive, uncomposed, or fundamental; red, yellow, and blue. In every musical composition there is a key note, or tonic, to which every other note has a relation; and if this relationship be broken, discord is the necessary result. Thus is it with the combination of colours, for in every painting there should be a key or tonic, to which all the several parts have a more or less direct relation, and hence it is that artists speak of the tone of a painting. The word tone thus used has a different meaning from that given to the same word in music; for it is there universally applied to a single note, and not to a combination of musical sounds. The word is also applied to the human voice or a musical instrument. Thus we speak of a rich, soft, or sweet tone; and the same term is equally applicable to a colour. It would indeed be desirable to give a new application to the word in painting, although this is at all times difficult, and frequently causes much more serious inconvenience and error than arise from the use of an inappropriate phrase, or an injudicious construction.

Although there are but few distinct colours, there is an infinite variety of tints, shades, and hues, which variously influence the eye, and give the artist a sufficient variety for the production of the effect he may desire.

The word tint is applied to colours in relation to their lightness, or, in other

words, their gradation from the most perfect or intense state, to that in which the colour is lost, and white is obtained.

By shade is meant the relation of colours to darkness, or their gradation from the most perfect state to that in which they approach nearly to black.

Hue is the aspect of any colour, not being a primary, as changed by an alteration in the proportion of its compounds. A primary colour, that is either red, yellow, or blue, may vary in tint or shade, but it cannot in hue; for the addition of any other colour will entirely change it, and give it another name. The colours formed by the union of the primaries, may be changed almost without end, by mixtures in various proportions; so that their hues are innumerable. Orange, for example, is composed of yellow and red, and according to the predominance of one of these over the other, so will be its hue; and green may in the same manner vary from that which is most yellow to that which is most blue. The more compound the colour in its formation, the greater will be the number of its hues.

Although a variety of colours are made and used by painters, they may all be formed, and of any hue, tint, or shade, from the three simple indecomposable colours, red, yellow, and blue. To show the manner in which this may be done, so that the science may be made intelligible to the meanest capacity, is our first object.

Fig. 2.

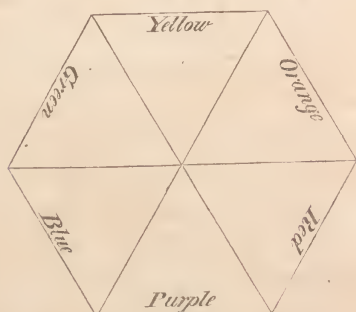
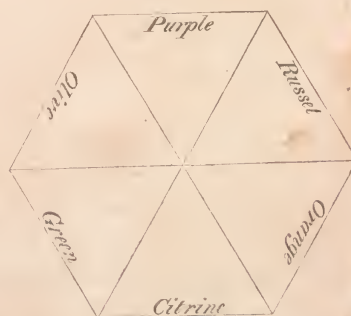


Fig. 3.



From the union of the three primary colours in pairs, are produced three others, called secondaries, as shown in *Fig. 2*. The mixture of yellow and red gives orange; of red and blue, purple; and of blue and yellow, green; the hue inclining to that one of its component colours, which happens to abound in its formation.

From the secondary colours, another class, called tertiaries, may be produced. Purple and green when united form olive; green and orange, citrine; purple and orange, russet; as shown in *Fig. 3*.

From the union of the tertiaries, other colours are produced, called browns; but of these it is not here necessary to speak. When the three primaries are united in certain proportions, they produce black, as is well known to every person who has been accustomed to the use of colours. To form a perfect black, blue must be the predominating colour; and the yellow must be subordinate to the red. By the union of the same colours in different proportions, greyish tints, varying according to the quantity and intensity of the colours, are formed. Black and white are the extremes of every chromatic scale, and may be considered the negations of colour.

These few remarks will explain to every reader the formation of colours; and we will now attempt to show the manner in which these colours should be arranged, so as to produce a pleasing impression upon the mind of an observer. It is scarcely necessary to state that colours placed in contact with each other without regard to any principle, that is in a miscellaneous manner, are not calculated to satisfy or please the eye; for if the reader has not been already convinced of the fact by the observation of numerous displeasing combinations, it will be only necessary to examine attentively the decorations commonly introduced into our dwelling-houses. Any two of the primitive colours, for instance, form a combination of this kind; and even when the three are presented at the same time to the eye, they produce a sensation to which it will perhaps be difficult to give a name, but one which is not perfectly satisfactory. There are, however, other colours which, when brought into contact with the three primaries, in a certain order, give instantly the relief that is required, so that every one admits that they are in harmony.

The word harmony, in its general use, signifies a relationship, or union of effect. There is a harmony between sounds, which causes two or more notes of a particular class, when struck at the same moment, to be heard with pleasure; while others of another class, produced in the same manner, and with the same relations as to time, so affect the ear, as to cause a sensation of discord. So two or more colours when brought into contact, and acting upon the eye at the same moment of time, create effects similar to those produced by sounds, whether of harmony or of discord.

When any combination of colours is pleasing, it is said to be harmonious; but the word harmony, as applied by painters to the principles which regulate the arrangement of colours, is, we fear, but little understood, and, as now used, is certainly calculated to mislead the student; so that it is necessary to give it a more definite meaning. If employed to express a general result, it cannot be

mistaken, for when it is said that the colouring of a picture is harmonious, every person would suppose that the colours had been so applied as to produce, when viewed in combination, a pleasing effect. But the production of this effect depends on the observation of certain discovered laws, and in the explanation of these, artists are accustomed to speak of the harmony of succession, and the harmony of opposition. It is to the latter expression that we object. The words harmony and opposition have, in ordinary phraseology, contrary meanings. When we speak of two things being in opposition, it will be supposed, not only that they have no relation to each other, but that they are also, in nature, decidedly opposed. But this is not the meaning which the painter gives to the word in the phrase harmony of opposition, for it is evident no two colours can be in harmony, because they are thus opposed. A student, however, meeting with this expression, would naturally infer, strange as the supposition must appear to him, that because two colours are essentially different in their natures, and form the strongest possible contrast, they may be so applied as to have an harmonious effect. But those who first used the phrase merely wished to state, that the colours which are opposite to each other in a particular arrangement of the chromatic scale, are in harmony. It seems, therefore, desirable to reject this phraseology, which is not only ambiguous, but is calculated to create an exceedingly erroneous impression. The same objection cannot be urged against the phrase harmony in series or succession; for this instantly conveys to the mind an idea, that some discovered series or succession of colours is harmonious, and consequently pleasing. The very words convey a meaning not to be misunderstood, so that the task of explanation is greatly facilitated. It is not easy, perhaps it is impossible, to find a phrase which would be less objectionable than the expression harmony in opposition. The phrase harmony in composition might be employed, although it does not convey a meaning incapable of being mistaken. But when the student is impressed with the fact, that there can be no harmony between any two or more colours in which the three primaries are not present, as they may be in two colours, one of which shall be a primary, and the other a secondary, composed of the other two primaries, the propriety of the phrase will be instantly perceived.

A few general remarks will now be sufficient to illustrate the principles of harmony, as exhibited by colours, both in succession and in composition.

It has been already stated, that the three primitive colours, red, yellow, and blue, if placed in contact, would not be satisfactory to the eye; but rather form a combination somewhat unpleasant. These three colours, however, are found

in the prismatic spectrum, which is exhibited by nature on a large scale in the rainbow; but they are not there in contact, for they are separated by the secondary colours produced by the intermixture of the primaries, and these secondary colours melodise the various characters of the primaries, and cause the entire combination of colours to be harmonious. The secondaries are in this instance the melodising colours; and it will be instantly admitted, that no combination in nature or art is more delightful to the eye, than that presented in the rainbow. This then is the harmony of series or succession, and it essentially consists in so blending two or more colours, not in themselves harmonious, that the eye rests upon them with perfect satisfaction and pleasure. In the instance we have selected, the yellow is melodised by the green on one side and the orange on the other; the blue by the green and the purple; and the red by the purple and orange.

Let us now proceed to explain the harmony of composition, or of colours opposite to each other in the chromatic scale. By examining the chromatic scale, consisting of the primary and secondary colours, as shown in fig. 2, it will be observed that any two opposite colours contain the three primitives; for one being a primitive colour, the other will be a secondary produced by the union of the other two. Thus the red is opposed by the green, which is formed of yellow and blue; the yellow by the purple, which is compounded of red and blue; and the blue by the orange, which is formed of yellow and red.

It will now be perceived that it is because the colours which are in harmony are also in opposition to each other in the scale, that the phrase harmony of opposition, has been employed by painters. From this it will evidently appear, that for the production of harmony in any composition, the three primitive colours must be present; for the eye is so constructed with regard to light, that when two of the primitive colours are presented to the eye, the third must be exhibited for harmony sake: and two of them must be in composition, or in other words, form a secondary colour. Hence it is that we find purple to harmonize with yellow, green with red, and orange with blue. This also explains why it is that the colours, which by admixture destroy each other, producing black, or a greyish tint, according to their strength, are in harmony.

It is a curious fact, that the colours which are opposite to each other when the chromatic series is arranged in a circular form, should consist of the three primary colours; but it is worthy of more attention than a mere matter

of curiosity. From an investigation of the phenomena of colour, it has been discovered, that when the eye is strongly impressed with a primitive ray, it has the power of producing the harmonizing, or, as the philosophers term it, the accidental colour. This may be easily proved by experiment. If a red spot be painted on a white ground, and the eye be then intently fixed upon it, a border of a green colour will, after a short time, appear to surround it. If the spot be blue, the border will be orange; and if yellow, it will be surrounded by purple. In each case the accidental colour is presented, and all the three homogeneous rays, two of them in composition, are perceived. The experiment may also be made by turning the eye to a sheet of white paper after it has been intensely fixed on the coloured spot; for the accidental colour, sometimes called the ocular spectrum, will then appear. The spectra of different colours may be easily ascertained by using wafers of the colours whose spectra are required.

It has been stated, that if the eye, when it has been strongly impressed with a colour, be turned towards a sheet of paper, or any other white surface, a similar object, in the complementary or accidental colour, will be observed. A red wafer or spot, for example, being used, the complementary colour will be green. Dr. Brewster accounts for this by supposing the retina impressed by the red image to be for a time deadened by its continued action. The sensibility to red light being thus diminished, the eye is not acted upon by the red rays of the white light proceeding from the paper; so that it is impressed by all the rays which form white light, except the red. These rays are the yellow and blue, which form the complementary colour, green. This theory also explains why white is complementary to black. If a black wafer be placed on a white ground, and the eye be fixed intently on it, the part of the retina covered by it will be protected from all rays, for black is caused by the absorption of all the rays of white light, so that none reach the eye from such a surface. Let the eye be then turned from the object and be fixed upon a white ground, and it will then be observed that a white circle is formed corresponding to the black image on the retina; for while one part of the retina was protected by the black wafer, the surrounding parts were deadened by the white light.

Another curious experiment may be here mentioned, as evidently resulting from the peculiar action of the eye in producing ocular spectra. Take any object with a sharp outline, and suspend it before a screen of white paper, so that by placing two candles in a convenient situation, two images of the same object may be formed with nearly the same degree of strength; then place before

one of the candles a piece of green glass of a deep hue, and a most curious phenomenon will be observed, for one of the images will instantly become red, and the other will appear green, which is the complementary colour.

Many other instances of the production of the complementary or accidental colour, both in nature and in art, might be mentioned; but we shall allude to only one other, which may have escaped the attention of some of our readers. When a room painted in strong colours is illuminated by the direct rays of the sun, the white objects will, if the coloured light does not fall upon them, exhibit the complementary colours.

A strong analogy exists between the production of the accidental colour in the experiments we have mentioned, and the harmonies which are known by musicians to attend every fundamental sound. Those who are accustomed to play on stringed instruments, and have an accurate ear, are well aware, that when a string is put into vibration, and especially when touched on certain parts, harmonic sounds are produced, subservient to the fundamental note. They will scarcely be detected by an uneducated ear, but they are sufficiently distinct in bells.

From what has been now said, the reader will perceive that there can be no harmony of colours unless the three primaries are present, either in a simple or compound state; and it is equally evident, that there can be no harmonious combination without the adoption of some one colour as a tonic, which must be used in the same manner as a key note in music.

The tertiary colours are formed from the secondaries, in the same manner as the secondaries are produced by the combination of the primary; and the colours which are opposite in series, are in harmony, as may be seen by reference to *fig. 3*. The entire subject is placed in a very interesting aspect by an author, who describes the production of colours from white light as a violence done to unity; so that it is in restoring this unity without violating the relations or lesser unities, that the various harmonies are produced. In other words, that combination of colours which approaches nearest to the unity of colours, in what may be termed perfect light, is most pleasing. Colours which when united would not produce a neutral tint, cannot be in harmony. The more intimately the primaries are combined, the more perfect is the harmony; as is evident from the circumstance, that the educated eye is more gratified by a harmonious arrangement of the tertiary, than of the primitive colours. The uncultivated eye, however, is best pleased with the simple relations which are easily distinguished in the combinations of the primaries. But it must be borne in mind,

that "there is a bound to this refinement of harmony, when the relations of the primaries as principles become so remote or complex, that indistinguishableness ensues: and this bound is sameness or monotony. To what extent the power of vision may reach in this direction, or how far nature has gone, may be difficult to determine; but it is evident, in her works, that she delights most in the latter harmonies, and distributes the former with a sparing hand. Consonant to this also, has been the practice of those artists who have coloured best, in steering equally clear from the extremes of crudeness and monotony: accordingly, in nature and the best pictures, the broad harmony of landscape lies in the latter relations, while the more confined harmonies of flowers belong to the former."

The importance of this subject to the house painter is so evident, that a few remarks on its application will be sufficient. A knowledge of the principles of harmony in colours is, if possible, more valuable to the house painter, than to the artist who is engaged in painting from nature; for he has no means of relieving the strong contrast between two colours, by the introduction of lights and shades. It is very difficult, as artists are well aware, to introduce a light blue in a composition, so that it may be harmonious. Orange is its contrasting or accidental colour; but both are brilliant, and calculated to attract the eye. To meet this difficulty, attention must be paid to the tone. Suppose that the blue is to be the predominating colour, the orange may be of the gravest tone; but it is by a judicious introduction of light and shade that all the discordances of colouring are avoided. The house painter, on the other hand, has not generally an opportunity of obtaining effect in this manner, and, consequently, the selection of colours and hues is all-important to him.

A complete harmony of colours cannot be obtained without regard to the tint. A slight reflection will convince the reader, that however well two colours may be chosen as to hue, they cannot be in harmony if their tints be disregarded. Let us suppose the intensity of colours to be represented by a scale, in which 0 shall represent the greatest strength, and 100 the greatest degree of dilution. It must be quite evident that there cannot be harmony between any two colours, however well chosen in other particulars, which differ greatly in the intensity of their tints, being, for instance, at the opposite extremes of the scale. We do not mean to assert that the difference of a few tints would destroy the harmony of any composition; for if such were the case, the pictures of the masters could never have attained their present value in the estimation of living artists. Nor must it be supposed, from what is here stated, that a similarity of tint is

always necessary in house painting, for on the other hand it is frequently desirable that there should be a difference in this particular, so as to give one colour a suitable prominence, and to quiet or enliven an arrangement.

The art of harmonious colouring is not of recent discovery. The Egyptians were well acquainted with it, and by them it was, in all probability, first applied in house painting. The Romans greatly esteemed the art, and practised it with eminent success, as is evident from the remains of Pompeii and Herculaneum: they were even accustomed to employ the most intense and brilliant colours, made necessary by the peculiar construction of their dwellings, and yet maintained the harmony. It is only in modern times that a knowledge of the harmony of colours has been dispensed with by decorators, and chiefly in England; for the French are better informed, and the Italians have adopted a system by which they give a peculiarly pleasing effect to their houses.

In applying the rules of harmony, the house painter must not forget the necessity of melody. A celebrated French author cautions his readers against the choice of colours fiercely opposed to each other, as they will appear, at a distance, like the colours upon our court cards, and they are to be especially avoided where they cannot be modified by shade, or by toning down. This remark is most worthy of observation, for in the decoration of houses it is always difficult so to harmonize and melodize the colours that every part shall be in some degree dependent on the others. No error of arrangement is so easily detected as the introduction of a brilliant unconnected colour.

The strongest possible contrast is that of two primaries, and by this the eye is greatly distressed, if the effect be not in some way relieved. The orange and the purple, and the orange and green, in which the yellow rays greatly predominate, are also strong contrasts, but not so powerful as the primaries. There are certain circumstances under which colours not harmonious may be introduced, as discords are sometimes allowable in music; but it is only a master in his art who can in either case introduce them with effect.

CHAPTER III.

THE ORIGIN OF THE PLEASURE DERIVED FROM THE PERCEPTION OF
COLOUR.

THE eye is the most important means of communication between external nature, and the internal sensibilities of man. To it we are indebted, and especially when it has been judiciously cultivated, for our most refined pleasures; many of which are scarcely less intense than those derived from the organ of hearing. The eye is equally active in communicating to the mind beautiful forms, and harmonious colouring; but it is from colour we receive the higher gratification. Forms, however graceful and elegant, are tame and lifeless. divested of colour; and the most exact representations of the most pleasing objects little interest the uneducated eye when divested of that natural attribute. To this cause, more than any other, may be assigned the comparative neglect of sculpture in the present age by all European countries. The ancients were strongly impressed with the value of colour in the communication of elegant forms and appropriate designs to the public mind, and consequently coloured nearly all their works of art.

The extreme sensibility of the eye to the impression of colour, is singularly evinced in the earnestness with which it is viewed by children and uncivilized men. It is reported by those who have visited countries inhabited by barbarous tribes, that they are ready to barter their most valued commodities for articles which have no other attraction than some strong and glaring colour. The more positive the colour, the more eagerly it is sought; and if an article of motley colours can be obtained, it is still more prized. Children, we know, have the same passionate attachment to gaudy colours; and if they do not prize them above all other things, they at least retain an interest for them when other toys are forgotten.

In the formation of all the organs of sense, through which the mind is affected by external objects, the Creator has provided for the pleasures as well as the necessities of life. The eye, considered in reference to its uses, is not only

intended to guard against dangers which would, without its aid, be unperceived, and consequently destructive, but is also so formed as to be a channel of continued gratification, resulting from the perception of external nature. The adaptation of the eye to the constitution of light and colour, is so perfect, that when the organ of sight has been strongly impressed with any ray, it has the power of producing the compensating colour, and of restoring that sensibility which had been momentarily destroyed.

This general adaptation of the eye in its formation to the constitution of light and combination of colour, does not prevent the existence of individual peculiarities. Although the principles of harmony in colours are as unchangeable as the laws which sustain the combinations of matter, and the existence of the universe, the same arrangement is not equally suited to please all persons, so that we frequently observe, both in individuals and nations, an attachment to one colour in preference to all others. To trace the origin of these individual and national peculiarities will not be found an uninteresting task.

It is exceedingly probable that the dislike evinced by some persons for particular colours, may be occasioned by a disorganised condition of the eye. These cases, however, are of rare occurrence, so that the emotions commonly produced upon the mind by colours must be traced to some more general cause. We shall in the first instance endeavour to ascertain the causes of a preference for certain colours in individuals, and then attempt to discover the origin of national peculiarities.

Nearly all the visible qualities of bodies as well as the pleasing or disagreeable effects of localities or scenes, have an intimate relation to the colours of those bodies, or the lights in which the scenes were observed. The mind consequently becomes accustomed from habit, to associate the existence of a colour with the scene in which it has been most frequently observed; and by a natural transition the impressions produced by the one are called into existence by the other. Blue is the colour of a serene sky, and diffuses over the mind an unusual quietude, and at the same time gives an idea of coolness and distance. Green is the colour of vegetation, and is connected with the ideas which are called into existence by the season it represents, and the hours in which its refreshing hues are most enjoyed. Red is the ordinary colour of flame, and is always spoken of as possessing a great degree of warmth and comfort. White is in the same manner the representative of light, and is cheerful to the eye; while black corresponds with darkness, and is expressive of sorrow, gloom, and fear. Hence then it appears that the most common ideas of colour,

as entertained by individuals, may be traced to the emotions produced by some objects or scenes in which those colours commonly predominate.

The use of colours by individuals may probably be traced to either a practical observation of their suitability and harmony, or the influence of fashion.

To the former cause we may attribute the frequent use of the rose hues by young females, and of violet and dark green by those more advanced in age. The fair-haired beauties select, with great propriety, violet as their favourite colour, especially for decorating the hair; but the brunettes choose blue. There are some females who have a passionate attachment for positive colours, and use them freely in their dress, but soon find that their complexions, indifferently good at the best, are much injured by the contrast. In this dilemma they adopt the artifice of creating a complexion for their ornaments, instead of choosing suitable ornaments for their complexion.

The choice of colours in dress, and the formation of taste in this respect, are determined by fashion, which has a wonderful effect in creating an attachment to particular colours. Instances will be readily called to mind of the introduction, especially in silks and other articles of ladies' apparel, of colours common to some of the meanest objects in nature—colours which, before they were chosen by those who guide the fashions, were altogether unnoticed, or only mentioned as producing an unpleasant effect upon the eye. As soon as these colours can be recommended as fashionable, an effort is made to view them with pleasure, and when they have been examined a few times, no doubt is left in the mind that they are exceedingly beautiful.

Colours thus chosen under the guidance of fashion do not long retain their hold upon the public approbation. Those which at one time appeared beautiful may at another fail to produce any pleasing emotion, or be even the objects of dislike. The colours, for example, which were selected by our ancestors appear to us so unsuited for garments, that the very idea of wearing a coat of the colour which best pleased our grandfathers, excites a smile. But some fanciful person, desiring singularity, chooses to adopt it. He is quickly followed by those who like himself love to be singular, and afterwards by the modest and retiring; and at last all persons agree in pronouncing it one of the most beautiful and appropriate, and in applauding the taste of former generations.

There are national as well as individual predilections for colour. These may be traced to a variety of causes, such as immemorial usage, national characteristics, climate, religious peculiarities, and facilities of manufacture.

Colours derive a character in all nations from their accidental uses for particular

purposes, or from their appropriation to persons enjoying particular offices or stations in society. In this country black is the emblem of death and mourning; white of purity and marriage; purple of royalty; and scarlet of war. Hence it is that colours, to use the words of an excellent writer, "become significant to us of many interesting or affecting qualities, and excite in us some degree of the emotions which such qualities in themselves are fitted to produce."

If we inquire into the predilections of other countries for colour, we shall find that they considerably differ from our own. Black in Spain and Venice is a distinguishing mark of rank, and consequently highly esteemed. White, which is to us cheerful and pleasant, the appropriate emblem of chastity, is in China the emblem of mourning. Bright yellow, which is not a pleasant colour for dress in our estimation, is held in great respect by the Chinese, because it is the imperial colour, and is associated with an idea of royalty. Hence, then, it would appear that colours do not please "from any original fitness in the colours themselves" to produce a mental effect, but from certain pleasing associations.

The choice of colours greatly depends on the mental characteristics of communities. The French, and other nations distinguished by a lively and energetic spirit, prefer intense and active colours; the English and Germans, who are sedate and thoughtful, select those which are more quiet and retiring; while the Spanish and Italians, who are anxious to maintain a becoming gravity and dignity, and yet possess much energy of mind and great elasticity of spirit, employ bright colours on the passive side.

Climate, also, has some effect in determining the national preference for colours. In northern countries, where the cold prevails, and the atmosphere is frequently heavy and dark, colours are but little studied, and may be almost said to have been banished. In southern countries, under a warm and cloudless sky, the brightest colours are generally preferred. This is especially remarkable in the dresses of the women, who, with their bright-coloured bodices and ribbons, seem to make a necessary part of every rural scene.

In enumerating the causes of national predilections for colour, the influence of religious opinions and ceremonies, and the dresses of the priesthood, must not be forgotten. In some forms of religion certain colours are more esteemed than others, and some are absolutely forbidden, as being entirely appropriated to sacred uses. The colours of the vestures worn during the times of worship are associated in all minds, more or less, with the sacred duties then performed.

The national manufactures may also be mentioned as having a great influence upon the adoption of colours. In those countries where silk is obtained at a low

price, the bright colours are common in women's dress, if the climate and mental characteristics of the people are suitable. If woollen goods be the staple article of manufacture, the more quiet colours are introduced. The Germans, it is said, very commonly wear blue, because it is a permanent colour in cloth.

From these and similar considerations, it must appear that the choice of colours is regulated by the circumstance or thing with which it is associated in our minds. We should not, perhaps, be justified in asserting that no colour is essentially beautiful; but it is certain that the pleasing emotions which they call into existence have their birth in some mental associations; although those that have no claim to our admiration are sometimes admitted into favour, and are for a time approved and adopted. In the same manner colours are adopted as the badges or representatives of employment or profession; and although ridiculous and disgusting to those who are not accustomed to them, they are pleasing to those who wear them, and soon become so to those who entertain a respect for the office.

The application of this subject to house-painting is so evident that it is scarcely necessary to make any remarks in illustration. National prejudices are scarcely likely to be invaded, for the painter himself indulges them as strongly as other persons; but he must be careful to ascertain the individual prejudices of those by whom he is employed. This will not always be an easy task, for he may have many tastes to please, and will frequently meet with those, who, being destitute of all knowledge of colour, will be unable to give any direct information for his guidance. Indirectly, however, he may gather sufficient to prevent him from choosing colours which are offensive to those by whom he is employed, and his own taste must direct their application in such a manner that they may appear pleasing to the more cultivated as well as the uneducated eye.

CHAPTER IV.

THE QUALITIES OF COLOURS, AND THEIR APPLICATIONS IN DECORATION.

In the preceding chapter we have attempted to prove that the attachment shown by individuals and nations to particular colours arises from some mental associations in themselves pleasing or painful. But it must not on this account be supposed that colours have no decided qualities of their own, for it is admitted by all who have studied their effects, that they are calculated to produce different sensations. They have therefore been distinguished from each other by the supposed possession of qualities analogous to certain properties of physical existence, and affections of the mind. They are thus said to be light or dark, warm or cold, powerful or retiring, gay or gloomy.

The origin and propriety of these terms may be easily explained. All colours may, in one sense, be said to be comprehended between the two extremes of light and darkness, so that white is the boundary on one hand, and black on the other. The first colour which appears on the one side is yellow, which is distinguished as a light, warm, powerful, and gay colour. Blue is its opposite and antagonist colour, being the other extreme; and is said to be dark, cold, retiring, and gloomy. Red is the intermediate colour, and is distinguished by the possession of strong, active qualities.

By the intermixture of the three primitive colours, yellow, red, and blue, all others are produced, and their qualities must depend upon the proportions in which the primitives enter into their composition. An infinite variety of tints, as is evident, may be obtained, and their qualities will essentially differ, according as the darker or lighter, the colder or warmer, may prevail. Hence then it will appear, that when the active principle is in excess, as for example, in yellow and orange, the colour will be powerful; when the passive, as in blue and violet, the colour will be retiring. The red, as already remarked, is an intermediate colour, and as its hues approach to yellow or blue, so will be its qualities.

There are but few positive colours, but the number of hues and shades is almost infinite. It must therefore be remembered, that in the description given in the few following pages of the primary and secondary colours, the author refers to them severally in their purest state. It is also worthy of remark, that the impression produced by any colour depends on the material in which it is exhibited. Silk and wool, although they may have received precisely the same dye, have by no means the same appearance. Every substance in nature is distinguished, not by its colour only, but also by an indefinable structure upon which that colour acts. It is not simply a roughness or smoothness, qualities which have a great effect upon colour, but some innate property which cannot be defined, and is but little understood. Colours in nature are, if the expression may be allowed, individualised; and hence it is that so much difficulty is felt in the attempt to imitate them.

The qualities of colours being known, their application and union in the art of decoration may be studied with some hope of success. These will be referred to in the subsequent descriptions of the several colours, but one or two general remarks will not be misplaced.

The passive colours, such as red and green, become grave, when introduced with black in any composition, but when conjoined with white, present a greater gaiety than otherwise belongs to them. So on the other hand, the active colours appear the more lively when associated with black, and lose some of their gaiety from a proximity to white.

The cool colours are injured by artificial light, but the warm are improved. Of this several examples will be given in a subsequent page.

The warm colours are naturally allied to light; the cool to shade,—a principle which may be exemplified from the works of any artist, but constantly forgotten by the house decorator.

In the application of colours in decorative house painting, the designer must constantly bear in mind the principles of harmonious colouring, as already explained in a former part of this work. By reference to the diagrams introduced for the explanation of this subject, the compensating colour may be instantly ascertained, but the artist may still fall into great error in its application. The colours when introduced in diagrams are made of an equal intensity, but the compensating colour formed upon the retina is always less vivid than the colour by which it was excited. So also it is never of the same tint or shade, being always either lighter or darker. Should any two opposite or complementary colours be contiguous, in pure hues of equal intensity, they will not produce an effect

which can be called harmonious. The hue and tint of a complementary colour must therefore be studied; for the mere introduction of a colour and its opposite, will not produce the effect desired. In this and in all cases the artist must interrogate nature either by a close observation of the natural production of colour, or by experiments.

This remark leads us to offer another important caution. The decorator too frequently indulges in the use of positive colours, a practice which must be severely reprimanded. It is not thus in nature; for the strong colours are subdued, and blend or mingle with each other, producing the secondary and tertiary, which are much more pleasing and satisfactory to the educated eye.

These are some of the most obvious principles which ought to guide the decorator in the choice and application of colours. An ignorance or neglect of them must occasion a failure in any attempt to please the man of taste. With all these in remembrance, the artist may fail in producing a pleasing effect; but if they are not made the foundation of his practice, he cannot succeed. A few remarks on the colours individually may be a further guide to those to whom the volume is particularly addressed.

WHITE. White, as we have already had occasion to remark, is an impression produced upon the mind by the action of perfect light upon the eye, as colours are formed from its decomposition. It is the correlative of black, both being the negation of colour; for one is occasioned, considered in reference to the action of direct light upon bodies not viewed by transmission, by the reflection of all the rays, and the other by absorption. Strictly speaking, we cannot be said to have any knowledge of a purely white light, for all light, as it is brought to the retina of our eyes, is possessed, in some degree, of the property of colour. A pure undecomposed ray never reached the human retina.

White harmonises with all the colours, and is melodised by yellow, which is the brightest and nearest allied to light; but when brought into proximity to it, all its powerful qualities are subdued, as the blaze and gorgeous brilliancy of an intense artificial illumination is extinguished by the rising sun.

White is generally spoken of as a colour, and several varieties are enumerated by artists and authors; yet it is evident there can be but one. Those colours which are called its varieties are light tints of certain colours, which may be easily proved by bringing them in contact with a pure white. Thus, for example, the colour which is called French white, is the lightest tint of purple.

Pure white was, a few years since, a common colour in house painting, but

is now almost entirely superseded by colours. It is, however, well suited for bed-rooms, especially in country situations, being exceedingly light, and having the appearance of great cleanliness. The colours which are introduced with it should be cool and light: the light greys, greens, or primrose yellow will be found most suitable. The warm and deep colours, and even approximations to them, must be most carefully avoided. It seems scarcely necessary to remark, that the furniture should be of the lightest wood, and the drapery be marked by the same general character.

YELLOW is the brightest of all colours, and when introduced in strong tints, and large masses, it is far from pleasing to the eye; yet in its nature is gay, and slightly exciting. In combination with red it forms orange, and with blue green. These secondaries are therefore its melodising colours. With purple it harmonizes, and with black forms a powerful contrast. In the composition of citron, which is the lightest of all the tertiary colours, and one of the most pleasing, yellow predominates; for it is formed of orange and green, in both of which yellow is present.

Although yellow cannot be extensively used in a satisfactory manner by the house painter, it is an exceedingly agreeable and imposing colour for hangings, but requires suitable relieving hues, that it may not be oppressive to the eye. The lighter tints may be introduced with great effect, with crimson or purple. It is also well suited in small masses for bed-rooms, and places where a cheerful appearance is required. The effect produced by yellow much depends on its purity; for when it tends to green, as in sulphur, it is not only an unpleasant, but almost a disgusting colour. Compare with this the colour of a piece of polished gold, or a rich yellow satin. The mention of the latter substance suggests the remark, that the effect of this colour in any fabric will also depend upon the fineness or coarseness of the material.

RED is a warm and lively colour, and in many of its tints extremely pleasing, although it produces a strong impression upon the eye. Scarlet, for example, is a colour almost universally admired: it has the brightness of the yellow, and the warmth of the pure red. It is extremely difficult to convey to the mind of the reader an idea of the colour which is signified by red, and it is not uncommon to hear the same term applied to very different pigments. Red, scarlet, and crimson, are terms frequently misapplied; nor is it perhaps easy to distinguish them by a written description, but it may

be observed, that scarlet is an approach towards yellow, and crimson towards purple.

Red is a colour which has so much warmth, that it communicates the quality to every hue in which it is a component part; and it might be said to every colour with which it is brought into contact. It is the intermediate between yellow and blue, and possesses intermediate qualities, differing from both. Green is its harmonizing colour; and it melodises with orange and purple. Russet is the tertiary in which red predominates.

Red, in its deep tints, has all the majesty and dignity of age, and in the lighter the grace and attractions of youth. Neither red nor scarlet can be extensively used in decoration, being too strong for the eye; nor indeed ought they ever to be employed by the house painter in masses, without great attention to the toning. It has been remarked by Mr. Hay, that when the light of a room is thrown directly on the floor, and not on the walls, bright scarlet may be used with an effect which is greatly heightened by the judicious introduction of gilding. Crimson is a generally useful colour in decoration, and exceedingly rich. It is a good ground for pictures, and the gilding of the frames is well relieved. Mr. Hay says, that the crimson associates well with gilding, because it partakes in a small degree of the property of purple as well as of red; the one being the contrasting colour to yellow, and the other the melodising colour to orange; the colour of gold in its lights and shadows producing these two. Crimson is preferable to scarlet, from its being more cool and mellow.

Many of the flocked papers now so extensively used in domestic decoration, are of a crimson colour, but not a few that are so called might with more propriety be termed scarlet. There are others which have a crimson pattern and pink ground, and these are to be especially avoided; for while the colour of the ground is diminished in intensity, by age and exposure, the flocked pattern is darkened. In these remarks it is not intended to object to the introduction of rose colours with crimson in general decoration, for they may be employed with great advantage, but only to their use in flocked papers. Great luxuriance and beauty of effect is obtained by the judicious use of pink and rose colours in cool-toned compositions.

Green is the harmonising colour to red, but much care is required in its application, or the contrast will be too violent. Russet, the tertiary in which red predominates, is a very useful colour to the decorator, especially in all warm-toned compositions, and is the contrasting colour to green.

BLUE is an intense colour, and the extreme of coldness as red is of warmth. It communicates a coolness to every hue into which it enters as a component part. It has the nearest relation to shade as yellow has to light. When the eye has been fully impressed by it, an anxious, restless, and susceptible impression is left. It has a peculiar effect; and, as Goethe says, is a kind of contradiction between excitement and repose. "As the upper sky and distant mountains appear blue, so a blue surface seems to retire from us. But as we readily follow an agreeable object that flies from us, so we love to contemplate blue, not because it advances to us, but because it draws us after it."

The quiet retiring effect of blue, and its pleasing influence upon the mind, will account for its not unfrequent introduction in various styles of internal decoration. It is used with most propriety in rooms which have a southern aspect, and in summer residences. In nature, blue is more abundant than either of the other primitive colours, and especially during the warmer seasons of the year; and from this circumstance the decorator may learn how he should apply the colour. When it is a leading colour it always gives an idea of greater extent.

Orange is the contrasting colour to blue, and green and purple the melodising; but green and blue, when brought into contact, are found to produce a less perfect melody than any other similar composition in the chromatic scale: they are therefore usually connected by a semi-toned colour. Olive, formed of purple and green, the tertiary in which blue predominates, is a soft colour, and invaluable to the decorator, especially in warm-toned arrangements.

PURPLE is a secondary colour, composed of red and blue, which are therefore its melodising colours. It is more active than blue, but is still retiring; it has a degree of liveliness, but without gladness. It has a singular variety of hues, according as it approaches to red or blue; being bounded on the one hand by crimson, and on the other by indigo. Its various tints are distinguished as lilac, peach blossom, and other terms, derived from flowers and fruits.

Purple is not often used as a leading colour in decoration, for however pleasing it may be when viewed in a natural, all its effect is lost in an artificial light. The reason of this is evident: the flame of a candle or lamp is yellow, and this is the contrasting colour of purple, which is consequently partly neutralized. Purple may be used in small masses, with the warmest tones of yellow as a contrasting colour, and is found to give great effect. When combined with green it forms olive, and with orange a russet; the former of which is a soft, and the latter a strong and powerful colour.

French white, which is the lightest hue of purple, may be used in a drawing-room as a leading colour; all other colours, whatever they may be, being kept light and cool. In this case the furniture should be of satin wood, or of some other light-coloured material.

GREEN is formed from the union of yellow and blue, which are its melodising colours. Red is its contrasting colour. Its hues are various, but they all retain the same name, being distinguished by some epithet, which is a singular circumstance, as all other colours receive new names as they approach to one extreme or the other; but whether the proportion of blue or yellow be the greater, the colour is still called green.

This colour is, more than all others, satisfying to the eye. In the largest masses it does not produce a feeling of satiety, but on the other hand seems to refreshen the more the longer it is viewed. It is the colour of the earth's vesture, and by its counteracting power the eye is enabled to bear the reflection of the sun's most intense rays. The wonderful adaptation of nature to the physical condition of man, is in this, as in all other phænomena, so evident, that it cannot fail to attract the attention of the thoughtful. The earth is spread out as a green plain, encircled by a canopy of clear blue, and these two colours are brought together by the warm and neutral grey of distance, while the innumerable reflections of light, in the air, and on the surface of the earth, throw an extraordinary warmth over the entire scene.

Green is an invaluable colour to the decorator, not only as a means of giving greater value by its rich tones to all arrangements of warm colours, but also as a leading colour in large masses. There is one objection to its use, that it loses its character when viewed by an artificial light. Mr. Hay gives an instance of its application, which is worthy of notice. "A rich hue of green upon the walls of a drawing-room, accompanied by cream colour, French white, and gilding on the cornice, ceiling, and wood work, with damask hangings of giraffe and gold colour, and a suitable carpet, never fails to produce a pleasing and splendid effect in any light. When this arrangement is inverted, that is, when the hangings and chair-seats are green, and the walls of a warm tone, the effect is equally beautiful in day-light; but in artificial light it is injured by the green being neutralized, and the warm tone on the wall rendered more effective; thus making that which is principal in the arrangement, and of the smallest quantity, recede, while that which ought to retire and be subordinate, is brought forward."

ORANGE is composed of yellow and red, with which it melodises. It harmonises with blue. In combination with green it produces citron, and with purple russet.

Orange is a colour which excites the sensations of warmth and gladness. It is associated in our minds with one of the most splendid of natural phenomena, the setting sun.

Pure orange is rarely introduced in decorations, but may, under certain conditions, be used; and produces a gorgeous effect. When yellow predominates in its composition, purple must be employed as its complementary colour instead of blue, and when red predominates, green will harmonize with it.

BLACK is the negation of colour. In its introduction in any decorative composition the greatest possible skill and judgment is required; and this is so well known, that such an attempt is rarely made. It should only be introduced in cool arrangements, and should then be perfectly transparent. The Romans had the art of employing it with bright and intense colours, as we know from the remains of Pompeii and Herculaneum, and succeeded in producing most splendid effects. No other evidence is required of the perfect knowledge of colour possessed by the ancients, but it must be remembered, that the style of building among the Romans, and their habits of life, required a mode of decoration, and admitted of the introduction of a positive colouring, altogether unfit for modern times.

In concluding this chapter, it may be desirable to take some notice of the necessity of studying the application of colours in those instances where coloured or fancy woods are introduced. The decorator must, in such cases, carefully ascertain to what colour the wood is analogous, and then proceed in the usual manner in the choice of the harmonious and melodising colours. Thus, for instance, oak may be considered as a citron, and mahogany as a russet.

CHAPTER V.

COMMON ERRORS IN HOUSE PAINTING.

HAVING explained the principles of harmony, and the relations of colours to each other, it will be necessary to show the application of these subjects to the art of decoration, and to point out some of the errors into which the house painter is liable to fall, either from a partial or total neglect of the facts which ought to regulate the choice and arrangement of colours. No person having the slightest pretension to taste, or being in any degree acquainted with the science of chromatics, can have failed to observe the extreme want of propriety which characterises the decoration of modern dwellings. From the palaces of princes to the cottages of peasants the same neglect or ignorance of the established laws and examples of nature may be observed, and the eye is constantly offended either by a destitution of pleasing variety, or by a daring attempt to produce effect without regard to the principles which regulate the combination of colours in nature. So rarely indeed is it our good fortune to meet with a specimen of house painting free from one of these glaring faults, that works of no talent, but unimpaired by great errors, meet with an unqualified and warm approval.

That we have not over-stated the low and degraded condition of house-painting as an art, all who have paid any attention to the subject, in connexion with the science of colour, can bear witness. Nor can we feel a moment's hesitation in assigning the cause which has produced a state of decorative art so much to be deplored; for it is undoubtedly to be traced to an extreme and general ignorance of the existence of any established principles. Those to whom the execution of house painting is generally intrusted, are governed by what is called their taste; and if a reason were asked for the choice of one colour in preference to all others, none could be given, having a stronger claim to our confidence, than that "it was expected to have a better effect." It is true, that the habit of observation, and an eye naturally sensitive to the impression of harmonious colouring, may so far instruct the painter, that in the majority of

cases he may be tolerably correct in his judgment, though he can never, with propriety, feel a sufficient confidence in his opinions; but will always be left in doubt, if he possesses the modesty which is the common attendant of talent, and too frequently fail in his best works in maintaining the complete harmony of his colours.

These remarks are not made with a censorious disposition, but from a sincere desire to correct a great evil,—the depreciation of an important and difficult art. The house painter is not himself conscious that he should occupy the rank of an artist, and is consequently satisfied with his knowledge and his performances, if he can so handle his brush as to cover a piece of joiner's or plasterer's work evenly with any prepared pigment, and produce a tolerable imitation of ornamental woods and marbles. With this most inadequate conception of the art, he cannot feel surprised that it should be still more depreciated by those who intrust to him the decoration of their houses for the same reason that they employ a labourer in digging the foundations, not because they would find any difficulty in doing the work as well themselves, but because they would rather pay another than undergo the personal inconvenience and fatigue. We are quite convinced that this is the popular feeling, and for its existence the painter himself is to blame, having degraded his art to the rank of an employment which only requires patient endurance of monotonous labour.

We are here bound in candour to state, that some blame, in this matter, may be properly given to architects for neglect and indifference, if not for ignorance. It is true, that the larger portion of painter's work, executed in modern dwellings, is not under the superintendence of professional men, and they are not therefore, in one sense, responsible for its character or style; but on the other hand it cannot be denied, that if they devoted more attention and exercised more skill in the direction of the works placed under their control, the taste of those to whom is intrusted the execution of the work, and who have, in the absence of the architect, the design also, would be proportionally improved. In the internal decoration of large buildings, and places of public importance, architects are accustomed to exercise their knowledge and skill, and in talent they are not wanting; but works of lesser magnitude, to which class the residences of the great mass of the people belong, do not receive an adequate degree of attention. That this censure is much deserved may be proved by the present state of decorative art, and the existence of a separate class of persons, who, exercising jointly the occupations of the tradesman and the artist, have assumed the name of house-decorators.

The errors which unfortunately distinguish the present modes of house-painting are exceedingly numerous, and the attention of the reader would be exhausted by such a statement as would fully expose them; we shall therefore mention only those which are most glaring and at the same time the most common, and this seems absolutely necessary for the assistance of those persons who may study the art from these pages.

A disregard of uses may be considered one of the most glaring faults committed by the house-decorator. It is essential to a perception of beauty that the objects which claim the possession of this quality should be in every respect suited for the purposes to which they are to be applied. A want of adaptation is not to be compensated by any individual excellence which the object may possess. A painful emotion is produced by an inappropriate display of qualities which are calculated to please when introduced under suitable circumstances. The first thing, therefore, to be considered by the house-painter, before he can determine upon the decoration to be adopted, must be the use to which the place or apartment is to be applied. There are some apartments in which lively and even gay colours may be employed; there are others in which a quiet but rich colouring would be more effective; while in other situations unobtrusive colours are to be preferred. We have an illustration of this in the modern dwelling-house, every part of which should have a peculiar character of its own, and one suited to the purpose for which it was erected. That this subject may be brought more fully before the attention of the reader, it will be desirable to take a brief survey of the characters which should distinguish the various apartments of a well-finished dwelling-house, and as the remarks will be general, so they may be applied in all circumstances;—to the largest and most sumptuous edifices, as well as to the smallest erected with any pretension to taste.

There are in all houses rooms which are intended for general and constant use, and others inhabited only on special occasions, and intended for the reception of visitors. A distinction is generally made between these in the mode of decoration, much more lavish expenditure being thought necessary for the latter than for the former. The character of an apartment of any class cannot, however, be changed, although a degree of grandeur may be admitted in one used only on special occasions, not appropriate in one designed for constant use.

A drawing-room should be distinguished by a cheerfulness and gaiety of colouring. It is a place appropriated to the elegancies of social life, and should be so distinguished from every other apartment, that vulgarity might here at least blush at itself. The colours to be chosen in the decoration of a drawing-room, so as to

have the effect we have described, must be rich and striking, but should be chosen of such tints that a glaring or gaudy appearance may not be produced. A contrast of considerable strength is desirable, and gilding may be appropriately employed, as it will give an increased liveliness and elegance to the general effect. At the same time, it must be borne in mind that the walls are not to be made the principal objects in the room, but are in all cases to be subordinate to the furniture.

The same costliness and brilliancy of colouring is not allowable in dining-rooms, which ought on the other hand to be characterized by a degree of warmth and quietude suited to the more massive furniture, and the substantial or festive board. The contrasts must be less striking, and richness of effect must be obtained without the slightest approach to gaudiness. The Gothic architects, who thoroughly understood the decoration of a dining-hall, obtained relief by the introduction of rich and appropriate carvings.

There are sitting-rooms in which neither of these characteristic modes of colouring would be suitable. Parlours should be distinguished more by negative than positive qualities. The style of colouring in these important apartments should be quiet and unobtrusive. The rooms appropriated to the ladies of the house for the reception of company, and as ordinary sitting rooms for work or amusement, should be light and elegant. Libraries must have a grave and quiet colouring: they admit of a greater monotony of tint than any other apartment, the richly and variously bound volumes giving a sufficient diversity. Indeed, no decoration should be introduced that is not so applied as to give a more imposing appearance to the books with which the room is furnished.

Halls and vestibules should be painted in cool colours; so that, while they favourably impress the mind with the taste and wealth of the proprietor of the house, they may not by their splendour destroy the effect which would otherwise be produced by the various apartments. Staircases should be distinguished by an appearance of solidity, and a degree of grandeur proportioned to the extent and importance of the edifice in which they are introduced. They should always be so placed as to attract attention, and especially when they lead to richly decorated rooms, and may then be painted in warmer and brighter colours than would otherwise be allowable.

Bed-rooms should have a cheerful and airy appearance, and to obtain this effect, light tints must be employed. In the decoration of these apartments, stronger contrasts are allowable than in any others.

The propriety of this choice of characters will be apparent to all our

readers, and it will be quite unnecessary to make any attempt to prove that it is often neglected. Nothing is more common than a dining-room painted in powerful tints and strong colours, as if it were to be the scene of the revels of the most degraded of our species, rather than of hospitality and social concourse. Parlours and ordinary sitting-rooms are either painted with an uniform monotonous and heavy colour, calculated to depress the spirits and excite melancholy; or in positive and strongly contrasted colours, which oppress the eye and distress the mind. The correction of these errors demands immediate attention, and it will be easily accomplished when the house-painter is convinced of the propriety of a change. In every case the purpose for which the apartment was built must be considered, and the artist must bear in mind that he has to sustain by associations those pleasurable feelings, of whatever class they may be, which are supposed to be there indulged.

In making choice of colours it is also necessary to consider the periods when the apartment is most likely to be used, for there are some colours which are destroyed or have an entirely different appearance when viewed by an artificial light. Yellow, for instance, loses much of its intensity, and green, a colour in some of its tints well suited for decoration, becomes dull and gloomy.

The aspect of a room is also well worthy the regard of the painter; for if it be, in this country, towards the south or west, the colours may be of a cooler tint than would be allowable if exposed to the north or east. The situation of the house, in town or country, is also to be considered; the rank and taste of the proprietor; and even the character of the natural scenery by which it is surrounded. It may appear altogether unnecessary to enter into such particulars as these, and a practice so contrary to that now adopted, will not, in all probability, be readily received. The house-painters of the present day will, for a time, continue the common and almost invariable disregard to these considerations; but, as information is extended and the true principles of decoration are made known, so the minds of practical men will be directed to the subject, and a better state of art be produced: with this hope the present volume has been written. In every application of colours it should be remembered that, when used by the aid of science and under the hand of a master, they are a language to the eye as music is to the ear; not a limited phraseology belonging to a particular class or race of men, but an universal language, suited to create and perpetuate pleasing emotions. House-painting may be an inferior branch of the art of design; but it is one upon which the comfort, elegance, and even mental progress of society is, in some

measure, dependent; for, as the mind of youth is partly formed by external associations, so a foundation may be laid for a correct judgment of colour, and an elegant taste, by a constant association of the mind with harmony in the very houses they inhabit.

A disregard of the styles of architecture and their appropriate ornaments is another common fault committed by the house-painter. It arises either from a want of knowledge or a want of skill; the latter is, we believe, the principal cause, for we have never met with an individual, among this class of mechanics, who has possessed a knowledge of architectural forms and decorations without having, at the same time, the ability to represent them. To this ignorance of the art of drawing may be traced the extreme want of propriety in the majority of those pretended decorations which are executed without the assistance of the architect. Anxious to do something more than common, the painter takes ornaments, which he thinks he can represent, and introduces them in his work without regard to their character, and frequently in such a style of art that they would have been better executed by the proprietor of the house, had he not lost the skill he acquired at school after his first quarter's lesson in drawing.

In the present day, apartments are frequently decorated in styles which require for their execution much skill in drawing and colouring, and especially where imitations of relief are desired upon plain surfaces; but these are not the work of the house-painter. An artist of a higher grade is employed to execute a design in arabesque, or any of those other styles which require a correct eye, a practised hand, and a cultivated taste; and this will continue to be the case until the house-painter himself forms a higher standard of excellence than that of spreading an even coat of paint upon a smooth surface of wood or plaster. Let it not, however, be supposed that, although we condemn the want of knowledge and taste among painters, we have any desire to throw a shade over the talents of those who, by study and laborious practice, have attained their art in all its excellence; our object is, by a comparison of them with others, to stimulate the trade generally to the adoption of a higher standard, and the attainment of greater skill. It is the want of necessary information that has degraded the art; and when this fact is acknowledged, the eye will no longer be offended by the want of propriety in design and colouring, or by the intermixture of ornaments as badly executed as they are injudiciously chosen.

From the errors, which may be called general, as infecting works of all classes, and destroying the effect of the best design, however perfectly executed, we may descend to some particulars which are not less important. Without

considering the propriety of a style of colouring, as suited to a particular apartment, and without reference to the choice or execution of architectural design, we may mention several common errors to be carefully avoided.

The want of a leading colour is the cause of great confusion, and destroys every attempt to obtain harmony in house-painting. In musical compositions there is a key-note to which every sound has a certain relation, and a disregard of it would cause discord. So in the art of painting, a key is required to which every other colour should have its proper relations. Without this it is impossible to introduce any suitable contrast, and the choice of one colour in preference to another is the mere result of caprice or a fancied superiority of taste.

In the choice of the key in decorative painting, regard should be had to the prevailing colour of the furniture, and this cannot be neglected without the commission of a great fault. The artist will frequently have some difficulty in making a selection on account of the various colours which are introduced in modern furniture. He will find it, in many instances, impossible to avoid the commission of some fault; and his ingenuity will be exercised in the selection of the least. The object of the house-painter should be to give the furniture of the room he decorates as much importance as possible, and to present it to notice in the most favourable light. The eye should not be attracted by strong and various colours upon the walls; but all parts of the room should be in harmony with the moveable articles in it, so that no one colour can individually attract attention. The strangely gaudy paper-hangings, so commonly introduced even in well-furnished houses, destroy the effect of the rooms in which they are used; and have probably done more to prevent the introduction of a chaste and correct style of house-painting than any other fashion or contrivance of ancient or modern times. The bright yellows and reds, with which so many carpets abound, are equally injurious to the decoration of the rooms in which they are introduced, for the eye is attracted by them, a gaudy appearance is given to the apartment, and the harmony of the whole is disturbed. With the choice of these the house-painter has, it is true, no opportunity of interfering; but, if they are chosen before his work commences, he may do something to relieve the effect, and if not, it is his duty to state what colours, and even patterns, should be avoided. In the majority of instances, however, no regard is paid to the selection of a colour as a key, and less frequently still is it chosen with a reference to the colour and tone of the furniture.

Vivid colours and strong contrasts are often introduced in house-painting, to the great annoyance of the educated eye. All positive colours are unpleasant

if unrelieved, and vivid colours should never be used by the house-painter except to give a greater richness and splendour of effect; and they must, even then, be used sparingly, and be subdued by suitable media. The cool-toned colours are invariably the most pleasing to the eye, and may be used by the painter with less fear than any others. In the introduction of contrasts much care, experience, and study, are requisite to produce the necessary effect. They are frequently employed to heighten the intensity of one colour and to subdue another. In the choice of the media by which these colours are united, a considerable knowledge of chromatics is required, for it is by them that the greatest distinctions are reconciled. The contrasted colours should also have a suitable relation in hue, tint, and shade. Supposing, for instance, that two colours are chosen to be used in contrast, the hues must be first selected, and then the tint of one must be made to approach as nearly to light as the other does to shade. Colours may be well chosen as regards their hues, but if their tints be neglected, a weak and faded appearance will still be the result.

We cannot close this general review of some of the errors common to the present system of house-painting, without remarking that a want of variety is not the least. It arises from conscious ignorance and its necessary attendant, timidity. Knowledge can alone correct this fault; and the requisite information we have attempted to give in these pages.

CHAPTER VI.

THE PRODUCTION OF COLOURS.

HAVING explained the philosophy of colours, and the principles which regulate their harmonious combination, it may be desirable to state, but with as much brevity as possible, the circumstances under which they are produced. In doing this, our object will be more to draw the attention of the reader to the subject, than to satisfy his curiosity; for the volume itself would not be sufficiently ample to comprehend an abstract of all the facts concerning the production of colour which have been accumulated by the research of the experimental philosopher.

Wherever the eye is turned it is impressed with colour. Almost every object in nature is coloured, and but few artificial compounds are destitute of the same property. This is true in whatever manner these objects are viewed, whether by transmitted or reflected light; and the eye itself, under some peculiar circumstances, seems to originate similar appearances. When we commence this study, we are lost in the vastness and complication of the phenomena which are on every hand presenting themselves; and long for some means of arranging them so as to comprehend the general causes before we enter upon a minute examination. As the uninitiated lover of nature would examine with attentive wonder a large and varied collection of shells, and after many futile attempts to arrange them in some order to facilitate his study, would close his efforts by making as many genera as species; so he who commences the study of colours from the phenomena of nature would probably find a new and distinct cause for almost every phenomenon. Should the naturalist, however, offer his assistance to the collector of shells, and selecting the most characteristic specimens of each genus, guide the delighted student in the arrangement, the difficulties which had so rapidly crowded around him would as quickly disappear, and that which had seemed confusion would be presented in the most wonderful order, each specimen being no longer considered as an individual, but a portion of a perfect system. So

by the assistance of philosophy, the student of colour is relieved from the consideration of each phenomenon as a distinct and separate appearance, and is directed to refer every individual instance to some general known principles; or if none of these will account for it, to discover in what particulars it differs, and to what causes these differences may be assigned. It is our desire in this chapter thus to assist our readers, and prepare them for the study of the causes which are active in the production of colour; but at the same time we would strongly recommend them the perusal of some treatise on the science of optics for a more ample explanation than it would be proper for us to attempt.

Colours are produced by the refraction, absorption, dispersion, and inflexion of light, and also by thick and thin plates, and by fibres and grooved surfaces. To these causes of colour may be added that of polarization, a subject of great interest, but requiring an extent and depth of research unsuited to the character of these pages. Of the other sources of colour, and of its production in the eye, we may give such a general account, as shall enable the reader to investigate those varieties observed in natural phenomena, and constantly presented to the attention of the thoughtful.

The propriety of a division of colours into two classes will be readily perceived. There are those which may be called permanent, and are usually described as characteristic of the bodies to which they belong; and there are those which are transient, appearing as the accidents of matter, if we may so speak, throwing a fleeting but vivid glow over the phenomena in which they appear. Both of these attract attention, and solicit research.

Every substance in nature may be said to have a colour, and in a description of the varieties of matter colour is mentioned as a special property. In the recognition of substances colour is one of the principal guides, associated with the perception of other qualities less easily described. It would not be difficult to find two substances having precisely the same hue, and yet so unlike in appearance that a child would be able to detect the difference. The colour however is, notwithstanding, a peculiarity by which both are known, and could they be dressed in other hues, they would be no longer recognized by those best acquainted with their qualities without the aid of some other sense than that of sight.

Some of those phenomena which are usually considered to arise from the inherent property of colour in the object by which the appearance is presented, are attributed by Goethe to the mere circumstance of density. Thus, for

example, the air when viewed in small quantities is colourless; but the vast canopy of sky which surrounds us has a deep blue colour. This colour cannot of course be considered as a property of space, and is therefore attributed to the atmosphere, which has so light a hue that it cannot be detected in small quantities, but becomes evident in large masses.

For this and similar phenomena Goethe accounts by a different theory. Light, however colourless, he argues, that of the fixed stars for example, appears yellow when the medium is thickened. If the density be increased, the light will gradually assume a yellow-red hue, which at last deepens to a ruby colour. If, on the other hand, he says, we look into darkness "through a semi-transparent medium, which is itself illuminated by a light striking on it, a blue colour appears: this becomes lighter and paler as the density of the medium increases; but, on the contrary, appears darker and deeper the more transparent the medium becomes; in the least degree of dimness short of absolute transparence, always supposing a perfectly colourless medium, this deep blue approaches the most beautiful violet."

To a great variety of natural appearances this very simple theory may be applied, and will give rational explanations, which will, to many minds, appear satisfactory. We may in this manner account for the blue colour of mountains when seen at a distance; the yellow or red colour of the luminaries when seen through an atmosphere loaded with vapours; the colours of fogs, and the red hues of a morning or evening sky.

The origin of colour in dense non-transparent bodies, which may be said to have in an especial manner individual and permanent colours deserving to be classed among their more essential qualities, we have already attempted to explain. Upon all substances light falls, and by it the eye is made sensible of their existence. When the light impinging upon the surface of bodies is absorbed, they appear black; and when only certain classes of coloured rays are absorbed, the colour of the object will be that of the reflected rays.

The production of colour by refraction has been explained with so much fulness in the first chapter of this work, that it will not be necessary to add much to our previous account of the phenomenon. We shall therefore chiefly confine our attention to the theory proposed by Goethe, for the explanation of the production of colour in this curious but common phenomenon; at the same time directing the attention of the reader to Mr. Eastlake's translation of "the Theory," and the valuable notes with which he has enriched his author.

Colour is not the necessary attendant of refraction, for if the surface refracted has no outline, colour is not produced. To illustrate this statement, the author proposes the following experiments. Place a large cube on any larger surface, and look through the glass perpendicularly or obliquely, the unbroken surface opposite the eye appears altogether raised, but no colour exhibits itself. If we look at a pure grey or blue sky, or a uniformly white or coloured wall through a prism, the portion of the surface which the eye thus embraces will be altogether changed as to its position, without our therefore observing the smallest appearance of colour. But when a circumscribed object is displaced by refraction, colour is produced. In proof of this statement take a white disc upon a black ground, and by the use of a convex lens magnify it, and an edge of blue will be seen to surround the object. Instead of a convex glass employ one that is concave, and diminish the object; it will then be surrounded with a yellow edge. In one case the white edge is advanced upon the dark surface, in the other the dark edge advances upon the white surface; and it is, according to Goethe's theory, only under these circumstances that colour is produced by refraction.

By an increased displacement of the object the appearance of colour is exhibited in a more striking manner. The conditions under which this is effected, are arranged under the five following heads.

1. When in looking through parallel media the eye is directed more obliquely.
2. When the surfaces of a medium are no longer parallel, but form a more or less acute angle.
3. When the proportion of a medium is increased, whether parallel media be increased in size, or whether the angle be increased, provided it does not attain a right angle.
4. Owing to the distance of the eye, armed with a refracting medium, from the object to be displaced.
5. Owing to a chemical property that may be communicated to the glass, and which may be afterwards increased in effect.

To exhibit the colours produced by refraction, prisms are generally used, and their suitability for this purpose is attributed to the circumstance that they occasion a greater change of place in the object.

In the first chapter of this volume we have explained the manner in which a ray of light is broken up into its constituent parts during its passage through a glass prism, and the vivid representation of colour which follows. This, as we have stated, is the result of refraction, and we may now remark, would be

observed if any other transparent substance were used instead of glass, or if any other kind or variety of transparent glass than that used were employed. The amount of refraction, however, is not the same with all media, but each transparent medium has its own index of refraction, so that the prismatic image formed by flint glass would not be thrown on the same spot as one produced from a prism of quartz or any other transparent substance, the form of the prisms, and the angles at which they are presented to the light, being the same.

A beam of white light being separated into a number of rays of different colours, each of those rays has its own course through the medium. This separation or dispersion of the coloured rays would seem to depend on the different refrangibilities of the several rays, the red being the least refracted. Now media differ greatly in their power of dispersion, a fact which was discovered by Mr. Hall, who ascertained that different kinds of glass have different dispersive powers. This gentleman ingeniously applied his discovery to the construction of achromatic telescopes. To prove the truth of this important statement, take two prisms, one of flint glass, and one of crown, of equal refracting angles, and so place these as to receive their spectra on separate screens, and upon comparing them together it will be observed that the flint glass has a greater dispersive power than the crown, or, in other words, its spectrum will be longer than that produced by the crown glass prism. Now it might be supposed that by an alteration of the refracting angle of the crown glass prism, these two kinds of glass might be made to produce the same spectrum, but when we have so changed the angle as to make the deviation of the red ray equal to that of the flint glass, the violet ray will not correspond. If therefore, the two prisms be placed together with their edges turned in opposite directions, the dispersion of the rays will not be corrected; for, although the dispersion of the red ray will be overcome, the violet ray being more refracted by the flint than by the crown glass, will remain as an uncorrected colour. It is possible, however, so to combine two substances, as to obtain a perfect image, and prevent those appearances of colour which would otherwise result from the dispersive power of the medium.

Another curious and exceedingly interesting class of phenomena now demand our attention. When light passes near the edges of bodies, we have presented to us not only the shadows of those bodies, but also a series of colours supposed to arise from the inflexion or diffraction of light. To observe this curious action of bodies upon light, fix any thin object, such as a hair, or a needle, in a

small aperture of a window-shutter, through which light is admitted into a darkened apartment, and receive the shadow upon a convenient screen. Three parallel fringes of coloured light will be seen to surround the shadow, decreasing in intensity in proportion to their distance from the shadow. The following is the order in which the colours appear in the several fringes.

First Fringe.—Violet, indigo, pale blue, green, yellow, red.

Second Fringe.—Blue, yellow, and red.

Third Fringe.—Pale blue, pale yellow, and pale red.

This singular phenomenon, produced by the inflexion of light, was discovered by Father Grimaldi, about the middle of the seventeenth century. Dr. Hooke, a man of great philosophic genius, appears to have made a similar observation about the same time, and claimed the discovery; but in reference to the priority of discovery, it is only necessary to say that Grimaldi published an account of his observations in his "*De Lumine, Coloribus et Iride*," in the year 1666; and Dr. Hooke did not publish his discoveries until a much later period.

Grimaldi's first experiment consisted in introducing a ray of light into a darkened apartment, when he observed that the beam of light diffused itself in the form of a cone. An opaque body was then so placed that it might be in the path of the ray; and when the image was received on a piece of white paper, he was surprised at the appearance of streaks of coloured light, each fringe presenting a blue colour on the side next the shadow, and on the opposite side a red. He also observed that the streaks were not all of the same breadth, but became narrower as they receded from the shadow.

The same observer ascertained that the shadow itself sometimes presents coloured streaks, not unlike the lucid border which surrounds it. These colours were more distinct when a thin narrow plate was used, than when a hair or a needle was introduced as the object, and the number of streaks increased with the breadth of the plate. But with the same plate Grimaldi could at pleasure increase or decrease the number of streaks by varying the distance at which the image was received. By various observations he also discovered that the breadth of the colours increased as their number diminished.

We must here state, that Dr. Hooke arrived, by similar experiments, but performed in a different manner, at nearly the same results as those ascertained by Grimaldi.

If a large beam of light be admitted into a darkened apartment, through an aperture in which a fine-edged knife blade has been inserted, two streams of light will be observed, which have been aptly compared to the tails of comets.

If two blades, the edges being perfectly straight, be fixed parallel to each other, with some mechanical arrangement by which the distance between them can be varied and measured, a different result will be observed; for, as soon as they are brought within a short distance from each other, coloured fringes will appear on each shadow, and become larger and more distinct as the distance between the blades diminishes. When, however, they are brought within about the four hundredth part of an inch from each other, the colours entirely disappear, and a shadow is observed dividing the light on the screen into two equal parts. As the blades approach the shadow grows broader, and the light decreases, until upon contact it vanishes.

M. Fresnel made several discoveries concerning the inflexion of light which are considered to be confirmatory of the undulatory theory. In performing his experiments he was much assisted by the discovery that the fringes might be viewed by an eye-glass without being first received on a screen; for, by adapting a micrometer to his eye-glass, he was enabled to determine the breadth of the shadows and colours to the two hundredth part of a millimeter.

Dr. Young was the first philosopher who attempted to explain the origin of those fringes of colour which are observed in the interior of the shadow. By him they are supposed to be produced by the interference of two portions of light from the opposite sides of the inflecting bodies.

Many other interesting experiments have been made upon this subject by Fresnel, Young, Arago, Brewster, and Fraunhofer, especially the last-named philosopher; but our only object in these pages is to explain the circumstances under which colour may be produced, and not to trace the opinions which have been derived from the circumstances under which they occur.

When white light is reflected from, or transmitted by, thin plates or films, colour is produced. With this class of phenomena all persons must be well acquainted in the brilliant colours of soap bubbles, and the splendid hues which appear on the cracks of broken glass. They were first observed by the celebrated Boyle in bubbles, and afterwards in glass, which he succeeded in blowing so thin, as to exhibit the same colours. If these colours be carefully observed, they will be found to consist of a regular succession of hues, not in any way dependent on the colour of the material, but evidently resulting from the greater or less degree of thinness in the plate or film by which the light is affected. In explaining the origin of these colours the investigators of optical science have had many difficulties to contend with, and it was in reference to these that Newton invented his celebrated theory of the fits of easy reflexion and trans-

mission. It is not our intention to advert to the various theories or hypotheses which have been proposed by opticians, to account for these and other phenomena, as it would be useless to mention them without investigating their claims to our credence, which would be a labour unsuited to our present undertaking; but we shall confine ourselves to the explanation of a few experiments in which the production of colours may be conveniently studied.

Goethe has distinguished seven conditions for the production of colour by thin plates.

1. When the polished surfaces of hard transparent bodies are in contact.
2. When a film of condensed vapour covers the surface of glass, or any other transparent body.
3. When the two former conditions are united.
4. When bubbles are exposed to the direct rays of light.
5. When fine pellicles and lamellæ, produced by the decomposition of minerals and metals, are acted upon by colourless light.
6. When metals are raised to high temperatures.
7. When the surface of glass is beginning to decompose.

To produce the colours by glasses, it is sufficient to have any two pieces of glass which can be brought together by pressure, and the experiment may therefore be made either with two convex glasses, one convex and one plane, or with one convex and one concave. In using either of these the colours may be produced by the slightest pressure, but as a near contact is required, the colours will be most vivid when a concave and convex glass are used together, and especially when ground on similar segments, as is the case with the object glasses of achromatic telescopes. It is also worthy of remark, that in making the experiment it is necessary to keep the glasses very clean. In examining the colours view them obliquely, for the more acute the angle under which they are seen, the larger will the circles appear. The object in using the glasses and bringing them close together by pressure, is to examine a thin plate of air, and by the same simple apparatus the colours produced by other fluids may be determined.

To exhibit the colours in a satisfactory manner, place a large convex glass of long focus, on some convenient surface, and on this place a well-polished plane glass, about three or four inches square, and the mere weight of the glass will be sufficient to produce some colour which may be increased in intensity by pressure.

In the centre will be observed a black spot, for here the glasses may be

supposed to be in immediate contact, and around it, rings of various colours, which may easily be divided into systems, of which five or six may be distinguished. In enumerating the colours of each system, the observers have, we think, fallen into error in stating all the varieties and gradations of hue produced by their intermixture. Sir John Herschel's description, which we may here introduce, is less objectionable in this respect than that of any other English author, but is at the same time less simple than it might be made.

1st System. Black, very faint blue, brilliant white, yellow, orange, and red.

2nd. Dark purple, or rather violet, blue, green, (a very imperfect yellow green,) vivid yellow, crimson red.

3rd. Purple, blue, rich grass green, fine yellow, pink, crimson.

4th. Green (dull and bluish), pale yellowish pink, red.

5th. Pale bluish green, white pink.

6th. Pale blue green, pale pink.

7th. Very pale bluish green, very pale pink.

Goethe describes them in a very different manner. Around the colourless centre, he says, there is a white space, and then appear various insulated rings, all consisting of three colours, which are in immediate contact with each other. "Each of these rings, of which perhaps three or four might be counted, is yellow on the inner side, blue on the outer, and red in the centre. Between two rings there appears a silver white interval. The rings which are farthest from the centre are always nearer together: they are composed of red and green, without a perceptible white space between them."

Similar coloured fringes may be observed on the cracks which are sometimes produced in crystallized transparent bodies, and on the separated plates of lamellated mineral substances.

Colours are formed upon thin plates of condensed aqueous vapour on glass or other transparent substances. Take a piece of clear glass, perfectly clean, and breathe upon it, and if the colours do not immediately appear, wipe off the moisture and breathe upon it again. A series of vivid colours will then be observed as evanescent as the shadowy clouds which fly over a summer sky. This beautiful phenomenon must have been frequently observed upon the moisture condensed on window panes, and is especially striking on the windows of a closed carriage in frosty weather.

The colours of soap bubbles are also well known, although it is difficult to ascertain their precise order and arrangement. That the production of colour in this instance is analogous to that in which glasses are used, is evident;

for, as a thin plate of air is confined within the surfaces of glass, in the experiment before mentioned, so a thin film of liquid is, in this case, confined between two strata of an elastic substance. Similar phenomena may be observed on the film which covers stagnant water, on drops of oil floating upon water, and also on water in which lime has been slaked. Another method of producing these colours, mentioned by Goethe, will be found to succeed. Pour a small quantity of aqua-fortis into a flat saucer, and drop into it, from a brush, some of that varnish with which engravers cover their plates in the process of etching. After a slight agitation a film will be formed on the surface of the liquid, upon which beautiful colours will be developed.

To these instances of the production of colour from thin plates, many others might be added, but the subject has been sufficiently illustrated to enable the reader to perform a few experiments for his own satisfaction and instruction, and he will thus be enabled to account for an extensive series of effects arising from the same cause.

We are now brought to the examination of another class of phenomena, the production of colour from fibres and striated surfaces. Upon this subject it will not be necessary to enlarge, as the formation of colour under such a condition is analogous to that of thin plates. Our remarks will therefore be confined to the statement of a few simple experiments.

When light is reflected from, or transmitted through, delicate fibres or striated surfaces, colour is produced. Take a disc of polished silver, and place it in such a position that a ray of light may fall upon it, and reflexion will be the result, but no colour will be observed. Then take another, in every respect similar, but with a scratched and uneven surface, and a splendid iridescent appearance will be presented, in which the green and red colours will predominate.

Instead of the roughened silver disc take a piece of plated copper, and wash it with aqua-fortis, so that the surface of the metal may be acted on, and when it is made to reflect light, the same iridescent appearance will be observed.

Mother of pearl has been long employed in the arts from the possession of this quality, and is an instance of the production of colour by striated surfaces. The changing colours in the plumage of birds may also be traced to the same cause.

The principle of the production of colour by striated surfaces has been admirably applied by Mr. Barton in the manufacture of the iris ornaments. This gentleman has invented an instrument for cutting grooves upon steel at a distance apart of from 2000th to 10,000th part of an inch. Steel thus cut

presents a most brilliant display of colours when exposed to the rays of the sun, or any artificial light. Buttons, and various ornaments for ladies' dresses, are made in this manner.

When a candle or any other luminous object is viewed through a piece of glass covered with moisture, it will appear surrounded with a series of coloured rings. In the same manner minute fibres, such as those of wool, exhibit coloured rings, which increase with the diameter of the fibres. This fact was applied by Dr. Young, in the manufacture of an instrument called the eriometer, which will measure objects to 30,000th-part of an inch.

Colours are in many cases produced under circumstances which lead us to attribute their formation to the eye itself. These appearances are presented under various conditions, but they are generally supposed to arise from an infirmity in the organ of sight, and are called accidental colours, or ocular spectra. It is quite true that a certain class of coloured objects do appear when the eye is in a diseased state, and these general terms may be applicable to them; but those which appear when the eye is in a healthy state, are probably to be traced immediately to the suitability of the eye to the impression of light, and the activity and susceptibility of that organ.

This subject is of great importance to the artist, having a direct influence upon his pursuits; and may therefore be explained more minutely than has been already done in the casual notices it has received in previous pages.

We may in the first place observe, that whenever the eye has been intently fixed upon any coloured object, so as to receive the impression entirely, it has the power of producing the opposite or complementary colour, when turned to any white surface. This fact has been already mentioned, and requires but little further illustration.

Take any small coloured object, a red wafer for example, and fix it upon a white ground. Stand at a little distance from the object, and fix the eye intently upon it for a short time, and then turning the eye to a sheet of paper or any other white surface, the complementary colour will be observed; which, in this instance, will be green. The experiment may be made with wafers of different colours, and the spectrum will always be the colour which is its opposite, as shown in the diagram, (page 19.)

This curious phenomenon is constantly to be observed, and the reader will be surprised if he watch the effects in the ordinary circumstances of life, which are for the most part passed without thought, from the very frequency with

which they occur. But the experience of most persons will suggest occasions when a remarkable or striking instance has happened in his own experience. Many persons have the habit, when thinking intensely, of fixing the eye upon some object in the room where they happen to be, and at such a time they may have witnessed, with a feeling approaching to alarm, the appearance of the complementary colour. Those who have worn green or other coloured spectacles must also have witnessed a similar effect.

To the same cause Goethe attributes a curious phenomenon, which has long attracted the attention of the observers of nature. Certain flowers are said to be phosphorescent, and to give out bright coruscations after sun-set. "On the 19th of June, 1799," he says, "late in the evening, when the twilight was deepening into a clear night, as I was walking up and down the garden with a friend, we very distinctly observed a flame-like appearance near the oriental poppy, the flowers of which are remarkable for their powerful red colour. We approached the place, and looked attentively at the flowers, but could perceive nothing further, till at last, by passing and repassing repeatedly, while we looked sideways on them, we succeeded in renewing the appearance as often as we pleased. It proved to be a physiological phenomenon, and the coruscation was nothing but the spectrum of the flower in the compensatory blue green colour.

"In looking directly at a flower, the image is not produced, but it appears immediately, as the direction of the eye is altered. Again, by looking sideways on the object, a double image is seen for a moment, for the spectrum then appears near and on the real object.

"The twilight accounts for the eye being in a perfect state of repose, and thus very susceptible; and the colour of the poppy is sufficiently powerful in the summer twilight of the longest days to act with full effect, and produce a compensatory image. I have no doubt these appearances might be reduced to experiment, and the same effect produced by pieces of coloured paper. Those who wish to take the most effectual means for observing the appearance in nature, suppose in a garden, should fix the eye on the bright flowers selected for the purpose, and, immediately after, look on the gravel path. This will be seen studded with spots of the opposite colour. The experiment is practicable on a cloudy day, and even in the brightest sun-shine, for the sun-light, by enhancing the brilliancy of the flower, renders it fit to produce the compensatory colour sufficiently distinct to be perceptible even in a bright light. Thus, peonies produce beautiful green, marigolds vivid blue spectra."

When the eye is impressed in the same manner with a colourless object, one which is black or white, a spectrum of that object is formed, the light parts being dark in the image, and the dark parts light. This is best observed when the eye is in a state susceptible of every impression. Whiteness or light excites the eye. Darkness has not this effect; but this sensitive organ is formed to receive the rays of light, and is distressed when in darkness for a continued length of time. When the light is in excess, the eye is contracted to exclude some of the more intense rays, but in darkness the pupil is dilated to collect the straggling rays of faint light which may happen to be present. The eye may by degrees accustom itself to either state. Those who work in chalk-pits, for example, are but little distressed by the strong and dazzling light of a summer's sun, which an eye less accustomed to the strong reflection cannot bear without much inconvenience and pain. So, on the other hand, a prisoner who has been long immured in a dark cell is affected by a light so faint, that those who are accustomed to the ordinary light of day are insensible of its existence. But neither of these individuals could bear a sudden change without much inconvenience, and even endangering the organ of sight. So strongly does the ordinary daylight affect those who have been long deprived of its genial influence, that it is many days before the individual regains the power of viewing things in faint lights without pain.

It will then appear that the eye is excited by light, and that in darkness it remains in a passive state, and to this a certain class of spectral appearances may be traced. If on waking from sleep in the morning, the eye be fixed upon the window-sash, relieved by the partially illuminated sky, and when impressed by the object, be turned to some spot perfectly dark, the image will be continued, for those portions of the retina which have been acted on by the light continue in an excited state, while those on which the image of the bars fell, were protected, and remain passive. A curious difference of result will be observed if the eye be turned to a light grey surface, instead of towards a surface perfectly dark; for an image the reverse of the other will be observed, one in which the panes will appear black, and the bars light. This is readily explained. The parts of the retina on which the image of the bars fell, remain in a state of perfect repose, and are therefore influenced by the faint light from the grey surface, while those parts which had been acted on by the light are distressed, and are consequently unaffected by the more feeble rays.

It will here be necessary to state, that in performing this class of experiments, the eye must not be exposed to the light for too long a period, or the retina

will, by a sympathetic action, be equally affected over its entire surface. The duration of these spectra will vary according to the spectator's power of vision.

When the eye is fixed upon a dazzling colourless object, the image will be retained for a long period. The experiment made by Sir Isaac Newton is generally known. This philosopher, anxious to ascertain the effect that would be produced by looking for a time on a bright object, fixed his right eye upon the image of the sun, reflected from a looking-glass. From this object he turned to a dark corner of his room, and there observed a bright spot, encircled by rings of colour, or, to use his own expression, a phantom of light and colours. Having injudiciously repeated the experiment three times, the image became so permanent that he was compelled to shut himself in a dark chamber, for three or four days, before he could recover the use of his eyes, and could then recall the image at pleasure.

Experiments of a similar kind were, at a later period, performed by Epinus, who observed that the colour of the spectrum was not the same when the eye was fixed on white paper, as when shut. Dr. Brewster repeated these experiments, receiving the impression on the left eye only, and he observed the same change of colour as had been previously noticed by Epinus. He also remarked, that when the right eye was uncovered it gave a coloured spectrum, a fact which confirmed Newton's statement; but in addition to this he ascertained that the coloured spectrum observed by the right eye was the reverse of that presented by the left.

From an observation made by Goëthe it appears that the colour of the spectrum varies according to the ground against which it is viewed. He happened to be in a forge one evening when a mass of iron at a red heat was placed on an anvil. From the iron he looked accidentally into an open coal-shed, and a large red image was observed; but as he turned towards the light boards of which the shed was constructed, the image appeared half green, half red, according as it had a light or dark ground.

To the same author we are indebted for an experiment which may be easily repeated by those whose eyes will bear the exertion. Having darkened a room, he admitted a beam of light through an opening which could be closed at pleasure. three inches in diameter. The light was received on a white surface, and he then fixed his eyes for a few seconds upon the bright circle thus formed. The opening being closed, he looked towards the darkest part of the room, and there observed a circular image, the centre of which was bright and colourless, and the border red. The red colour rapidly spread, and the entire image was in a

few seconds changed. No sooner, however, had it become entirely red, than the edge began to assume a blue appearance; and when the whole of the image was blue another change came over it, for the edge became dark and colourless, and the entire surface was soon brought into the same state. The image then became fainter, and diminished in size until it disappeared. In this experiment we have an instance, says the author, of the manner in which the retina recovers itself by a succession of vibrations after it has received a powerful external impression.

In the introduction of these few general remarks upon the production of colour, we shall perhaps be charged with a deviation from the immediate object of this volume. It is true, that for the practice of house painting the information contained in this chapter is not absolutely necessary, but it cannot be either uninteresting or unimportant to those whose business it is to watch and study, for the improvement of their art, the production of colour under all circumstances. Feeling, however, that the subject is only accessory, and not directly applicable to the pursuits of the artist, we have given but a general and brief description of the production of colour by various physical causes, and would therefore again recommend the further investigation of the subject; and, at the same time, enforce upon the attention of the reader, the fact that it is only by a continued and minute observation of natural phenomena that he can obtain a knowledge of the appropriate application of colour.

CHAPTER VII.

THE CHEMICAL COMPOSITION AND MANUFACTURE OF COLOURS.

A FEW years since, artists, even those who had obtained great celebrity for their works, and artificers of all classes, were satisfied with the possession of mere manual skill, scarcely ever entertaining a wish to be acquainted with the subjects incidental to their professions or trades. But in the present day, no man can reasonably expect eminence unless he be well acquainted with all those branches of knowledge which are indirectly connected with his pursuits. Hence it becomes necessary, in such a work as that we are now presenting to the public, to enter with some particularity into a description of the manufacture of the colours, oils, varnishes, and other materials employed by the painter; and even to describe the construction of his tools. It cannot be said that this information is absolutely necessary for the practice of the art; but it is certainly useful, and gives the artist an opportunity of providing against those physical and chemical causes of injury or decomposition which may impair or destroy his work. An intelligent or inquisitive mind cannot feel satisfied without this knowledge; for the questions will ever present themselves, what is the nature and composition of the substance which I am using? how is it made? and what is the probability of its retaining its colour? No apology therefore will, we are sure, be required for the introduction of this and the three following chapters.

That the reader may thoroughly understand the manufacture of colours, it is necessary that he should be acquainted with some of the properties of the substances from which they are produced. Nearly all the colours employed by the house painter are made from metallic compounds, and chiefly from lead, iron, copper, arsenic, mercury, chromium, cobalt, and zinc. From lead, in some cases combined with chromium, we obtain the white lead of commerce, Naples yellow, red lead, litharge, chrome yellow, and chrome green; iron, when chemically treated, gives the ochres, Prussian blue, sienna, the Venetian and mineral reds, the mineral yellows, and some browns; from copper and arsenic we obtain green

verditer, blue verditer, and mineral green; from mercury, vermilion; and from cobalt, Antwerp and Thenard's blue, and the zaffars or sky blues. The sulphate of zinc is used as a drier.

Were we to attempt a description of all the substances which enter into the composition of pigments, in their general relations to each other, we should far outstep the bounds which ought to circumscribe our path of investigation. To limit our inquiries, and at the same time to communicate information calculated for the general reader, is difficult; yet such is the object we have presented to ourselves. The formation of many colours involves abstruse chemical theories, which are not easily explained; and there are some results in this branch of manufacture for which the chemist himself is unable to account. Every science, also, has a language of its own, and its phraseology is not unfrequently a stumbling-block in the path of the student. With these difficulties we have to cope in our attempt to explain the manufacture of colour, without an opportunity of fairly meeting them by explicit definitions. It is, notwithstanding, possible to communicate much valuable information to the general reader, and, by chiefly regarding the principles, to enter with some degree of minuteness into an investigation of the subject. This we shall endeavour to do with as much brevity and perspicuity as possible in the following pages.

THE WHITES.

Although the various pigments which come within the general designation, "the whites," may appear to require but a short notice, they are of the greatest importance; for they necessarily form a ground to receive all colours, and by admixture with them produce the various tints used not only in house-painting, but in the higher branches of art. Many pigments are in themselves too transparent to be of any value to the painter; but when mixed with a white receive a sufficient body: in fact, we may say that it is white which renders all colours serviceable. The white pigment most used in oil painting has lead for its base, and is manufactured in large quantities by different processes, the most important of which will be explained; and it is known in commerce by the name of ceruse, or white lead. This is the only metallic white in extensive use. There are many pigments which have earthy bases well adapted for distemper colour, but they are rarely used with oil. The most important of these are Bougival white, Briançon, Spanish, Moudon, and Rouen whites, the composition and manufacture of which we shall endeavour to explain.

WHITE LEAD.—The ceruse, or white lead of commerce, is a combination of lead and carbonic acid. In the manufacture of this substance, there are many peculiar processes and manipulations, and scarcely any two makers adopt precisely the same modes; for they all differ slightly in the form of the apparatus, or in the application of heat. But the object is the same in all cases, the formation of a white carbonate of lead, by exposing thin sheets of metallic lead to the fumes of acetic acid, in a temperature of from eighty-six to ninety degrees.

The selection of the metal for manufacturing white lead is of the greatest importance; for if it be not pure the carbonate will not be perfectly white. The lead mines generally contain silver, and if this metal exist, in the most minute proportion, in the metal used for forming white lead, the product will not be without colour, as the silver is converted, during the process of making white lead, into an acetate or carbonate with the lead itself, and is of course intimately mixed with that metal. These salts of silver, when exposed to the air and light, have the property of turning black; but being mixed with the carbonate of lead, produce a greyish tinge throughout the entire mass, thus depriving the white lead of the appearance it would have were it in a state of purity. Should the presence of silver be suspected in lead, the purchaser or manufacturer may assay it in the following manner. Take ten grains of the lead, and placing them in a small white glass flask, pour thereon pure nitric acid, diluted with twice its weight of distilled water; about half an ounce of the dilute acid to the ten grains of lead. To facilitate the solution of the lead, hold the flask over the flame of a spirit or naphtha lamp, and if all the metal be not dissolved with that quantity of acid, add a little more by degrees until a perfect solution is made, which may, when cold, be filtered through white blotting paper. To this clear solution add some sulphate of soda, dissolved in distilled water, and filtered; a white precipitate, which is sulphate of lead, will be thrown down. The precipitate may be collected on a filter, and the liquid, which will be a clear solution, should be received in a small porcelain capsule. When the solution has been evaporated to one-half, pour it into a test tube of sufficient capacity, and test it with a solution of hydrochlorate of soda, that is, common salt. If any white curdy appearance be produced, it will be an indication of the presence of silver; but, to be more certain of the result, carefully collect the precipitate, and having added a few grains of carbonate of soda, expose it to the heat of a blowpipe on a piece of charcoal. When the compound is fused, an effervescence will ensue, the flux will sink into the charcoal, and a small globule of silver will remain behind,

which, when weighed, will give the quantity contained in the ten grains of lead originally subjected to the assay.

The lead of commerce sometimes contains iron, which is very injurious to the formation of a pure white pigment. To detect the presence of this metal, the lead proposed for sale should be carefully tested, which may be done in a manner similar to that already described. The lead must be first brought into a state of solution, as when the presence of silver is suspected, and the solution which remains, after precipitation by the hydrochlorate of soda, may be concentrated by gentle evaporation. A few drops of the solution of prussiate of potass should be then added, and if a greenish or a prussian blue colour be produced, iron is certainly present. When this metal exists in the metal used for forming the carbonate of lead, it gives a yellowish tinge to the pigment, and greatly detracts from the beauty of the colour.

Sulphur is sometimes found in the lead of commerce. It may be easily detected in the following manner. Take a piece of lead, about three or four grains, and, placing it on a piece of charcoal, cover it with carbonate of soda. Reduce the metal into a liquid state by the flame of a blowpipe, and when a bead of the lead and flux is produced, drop it into distilled water in a test tube. By the application of heat a solution may be formed, which, when filtered, should be tested with a solution of the acetate or nitrate of lead; if a brownish tinge be produced in the liquid, the analyzer may be certain that sulphur is present. Another method of testing the presence of sulphur is to touch the lead with a drop of muriatic acid, and if an offensive smell, such as that caused by rotten eggs, should be detected, there will be a sufficient indication of the existence of sulphur in combination with the metal; and the manufacturer may be certain that the lead is not sufficiently pure for the purpose to which he intended to apply it.

Having described the method by which the most common and injurious impurities in metallic lead may be detected, we will now proceed to give some idea of the process of manufacturing the white lead of commerce, as adopted in foreign manufactories, as well as in those of our own country.

At the manufactories of Bleyberg, where a white lead of very superior quality is produced, owing to the lead being very pure, and not contaminated with iron, the following process is adopted. The lead is cast into thin sheets, of about one twenty-fourth of an inch in thickness, which are then doubled over square slips of wood, or rolled so as to expose as much of the surface as possible.

These rolls of sheet lead are then suspended in strong wooden boxes prepared for the purpose, a small portion of vinegar and wine lees being previously placed in the bottom of the box. When a number of these have been made ready, they are conveyed to the stove-room, where the lead is exposed to the corrosive vapours of vinegar, or in other words, acetic acid, during a period of about fifteen days, at a temperature of eighty-six degrees Fahrenheit. If the process be carefully managed, as much carbonate of lead will be produced during this time as will be equal to the metallic lead employed, that is to say, for 300 parts of lead an equal quantity of carbonate of lead, or ceruse, will be obtained. Some metal, however, remains, which is returned to the melting pots, and again produced in sheets. The carbonate thus formed, when shaken from the lead, is thoroughly washed in large cisterns of wood, which are divided into different compartments, so as to separate the finer from the grosser portions. When thoroughly washed, it is dried in vessels of a convenient form, and is then ready for the market. The white lead in the last compartment is esteemed the best, and on the continent is termed silver white.

Other processes are employed in this country, but the principal difference consists in the mode of obtaining a sufficient heat. The following method is very generally adopted. The sheet lead is so rolled up in coils as to expose as great a surface as possible, and each coil is then placed in an earthen pot, which has a ledge in the inside on which the lead rests without touching the sides of the vessel. Vinegar is then poured in to such a height that it may nearly touch the lead. The pots being thus charged, are imbedded in stable litter, and left, on the average, for a period of about two months. The heat arising from the fermentation of the bed, causes the lead to be surrounded by the acetic vapour which is thrown off, and an oxide of lead is formed, which combines with the carbonic acid, forming a carbonate of lead, or ceruse. It is removed from the surface of the metallic lead in encrusted cakes of uneven surface, sometimes showing signs of crystallization, arising from the presence of a portion of the acetate of lead with the carbonate. These cakes, after being separated from the remaining metallic lead, are levigated in water to the requisite degree of fineness, and when dried are brought into the market as an article of commerce. Professor Tingry informs us that the lead is oxidized by the vinegar, and receives its carbonic acid from the fermentation of the substances of which the hot-bed is composed. This theory we are greatly inclined to doubt. If the vinegar only oxidizes the lead, as Professor Tingry states, what becomes of its remaining constituent parts?

If the Professor examines this subject a little more closely, we imagine he will find the constituents of carbonic acid in the decomposition of the acetic acid, without searching for them in stable litter or exhausted tan.

Many other methods have been proposed for the preparation of white lead, and numerous patents have been at different times taken out by sanguine speculators. In the year 1821, Mr. John Sadler obtained a patent for the manufacture of white lead, by decomposing the subacetate of lead, in solution, by a stream of carbonic acid; which gas, combining with a portion of the lead, causes the precipitation of a carbonate, leaving a supernatant liquor of acetate of lead. It now, however, appears, that all those carbonates of lead which are formed by precipitation take, more or less, a crystalline form; that is to say, each molecule or atom has a definite geometric shape, with sides and angles, which prevents the substance, when employed as a pigment, from spreading easily under the brush, and even from combining homogeneously with the oils employed in painting. The carbonates thus formed cannot therefore be made to cover a space equal to that of the same pigment prepared by slow corrosion.

In 1826, a patent was granted to Mr. Groves for the manufacture of a sulphate of lead. This gentleman employed for the manufacture, sulphuret of lead, or common native galena, and treated it with nitrate of potass and sulphuric acid. By this means he formed a sulphate, which is a pure white pigment, incapable of being discoloured; but it cannot be used with the same facility as the carbonate, on account of the extreme density of its molecules.

The carbonate of lead, as brought into the market, is frequently adulterated with chalk, that is, carbonate of lime; plaster of Paris, or sulphate of lime; and the sulphate of barytes; all these are very common ingredients, and may be severally detected in the following manner. Dissolve a few grains of the white lead in dilute nitric acid, and to the clear solution add sulphuret of ammonia; a black precipitate, which is the sulphuret of lead, will be thrown down. The supernatant liquor, when clear, may be tested with oxalate of ammonia, and if a white precipitate fall, it denotes the presence of chalk, or carbonate of lime. If the whole of the carbonate of lead does not dissolve in nitric acid, but leaves an insoluble white powder, we may suspect the presence of sulphate of lime, or barytes; or it may be a portion of sulphate of lead. To determine whether it is the latter substance, mix it with a small portion of carbonate of soda, and fuse it before the blowpipe, on a piece of charcoal. When decomposition has taken place, a globule of lead will be formed, if that metal be present; and if it does not reduce with the soda, it is composed either of lime or barytes.

White lead is one of the most important pigments in house-painting. It has the property of combining readily with the oils, and of forming a smooth surface, when employed by the painter, spreading easily under the brush. While it fills the pores of wood, it supplies a means of producing a surface of any colour that may be required, and its durability and protecting properties render it invaluable as an article of economy, comfort and luxury. To the artist it is indispensable; it forms the grounds of nearly all his colours, and without it he could not avail himself of those varied and beautiful tints which are now so easily formed by an experienced workman. With its aid, he is able to employ many colouring matters, and to produce tints from them which could not otherwise be obtained. The innumerable tints and hues of blue, green, red, crimson, yellow, brown, and other colours, depend on the admixture of ceruse, or carbonate of lead, with a colouring matter; and the same substance, by its combination with black, forms various tints of grey, and the pearl whites: in fact, it may be termed the vehicle of colour. When ground with oil, and in a state of paste, it forms a valuable and durable cement, impervious to heat, cold, and water; indeed, its uses to the painter and in the arts are too numerous to be mentioned. Until it is required for use, it should be carefully kept covered from air, light, and dust, and should never be employed in places where fœtid smells arise; for any gas or vapour containing sulphuretted hydrogen, however minute the proportion, will tarnish its brilliance. In many gems and paintings of value this discolouration of the white lead is common, and has been produced by their exposure to noxious vapours. The parts which were painted white, and the lighter tints, are thus converted into sulphuret of lead, which gives a dull metallic-looking surface that entirely destroys the beauty of the painting. Several of the finest old pictures were in this state; and it was for a long time thought that no means could be discovered of restoring the original tint. Various processes were tried; but all were found to injure, more or less, the painting. Baron Thenard, however, ultimately succeeded in restoring those blemished works of art to their original state, by means of the oxygenated water, which, when applied to paintings injured by exposure, converts the lead coloured sulphuret into a permanent white sulphate, and causes a vivid restoration by the formation of a new pigment. In a subsequent part of this chapter we shall give the method of preparing the oxygenated water, which must be an article of paramount importance to the artist, the connoisseur, and the public.

FLAKE WHITE.—There is an article of commerce called by colourmen flake

white. It is usually sold in the form of small pyramidal drops; but in its composition does not much differ from the ceruse. It is, in fact, a carbonate of lead of superior purity, more care being taken in the washing, levigation, and other processes of manufacture. This is the colour commonly used by artists; and being employed in works of time and value, the manufacturer should be exceedingly cautious in the choice of the lead from which it is produced, as any alloy or impurity must inevitably cause a diminution of brightness in the pigment. The water used for washing should also be carefully tested, as it frequently contains large quantities of lime, and sometimes traces of the hydrosulphurets, both of which are injurious to the pigment; the former, in regard to its density, and the latter, in relation to its brilliance.

KREMS, or CREMNITZ WHITE.—The pigment called Krem's white is a pure ceruse; but a great variety of preparations, composed of heterogeneous substances, are commonly brought into the market, and sold under the same name. A mere mention of all these preparations would occupy a greater space than their merits deserve, and we shall therefore refer to only one or two. That which is the best is formed of oxide of tin, oxide of zinc, and pure clay. It is too expensive to be used by the house-painter, but is useful to the artist, for it is a perfect colour, and is not liable to any change from the action of the atmosphere, or the vapours with which it may on occasions be loaded. The worst of these preparations is, that which is composed of the oxide of bismuth; a substance which is altogether unfit for use as a pigment, being much more liable to change and discolouration than the most common ceruse.

In the preparation of the Krem's white, it is in the first place necessary that the metallic lead employed in the manufacture should be perfectly free from silver, which is difficult to be obtained. Great care also is required in the various processes by which the metallic lead is converted into a carbonate. The mode in which the manufacture is performed differs, it is true, from that adopted in this country in making the ceruse, and it is probable that the carbonate thus obtained is more perfect, as it is more quickly produced; but the extraordinary care, the avoidance of every source of discolouration, and the extreme fineness of the produce, tend, more than any other causes, to give the Krem's white that superiority to other preparations of carbonate of lead which it is allowed to possess.

In the manufacture of the Krem's white, the heat of a stove is substituted for the stable dung. It has, however, been found that when this is done it is necessary to provide a supply of carbonic acid. The lead plates, which are about

the twelfth of an inch in thickness, are placed in deal boxes, as already explained, and thus exposed to the united action of the vapour of vinegar and carbonic acid gas. The vessels are charged with vinegar to within about three inches of the plates, which are arranged in the form of chevrons upon lath, and the carbonic acid is obtained by the addition of the lees of wine, or tartaric acid, or by the immersion of a piece of marble. The boxes being closed, are placed upon a square hot air-tube, and kept at a proper temperature, so that the vinegar may sufficiently, but not too rapidly, evaporate. In about fifteen days, the process is complete. The subsequent washing, to remove all impurities, is performed in a manner similar to that already described.

The theory of the formation of ceruse is one of great difficulty, and has not yet been explained by chemists. The necessity which is said to exist for the supply of carbonic acid, in the manufacture of the Krem's white, still further confuses us, and has induced many writers and eminent chemists to believe that the carbonic acid is procured from the dung or tan used, in this country, in the manufacture of white lead. For this supposition we can, at present, discover no other reason than that it is difficult to explain its formation in any other manner. The vapours which arise from animal matter during its fermentation are, no doubt, numerous, and among them the hydrosulphurets are not the least important. This method of obtaining the required temperature is, therefore, most objectionable, and that the lead is converted into a carbonate by its means is extremely doubtful. M. Mérimée states, that he performed two experiments, from which he deduces that the carbonic acid is supplied by the stable litter; but they do not appear so satisfactory as could be desired. Upon a vessel containing vinegar, he placed plates of lead, and covered the whole with a bell-glass, which he luted to a suitable stand. Another apparatus was prepared in the same manner, but some pieces of marble were added to the vinegar for the formation of carbonic acid. In the former case, acetate of lead was produced, and in the latter carbonate, as might be expected; but the atmospheric air being excluded, the experiments do not fairly lead to the conclusion that the carbonic acid in the manufacture of ceruse necessarily arises from the stable litter.

WHITES WITH EARTHY BASES.—Various other whites, having earthy bases, are used by the painter; a few in oil, but the greater number in distemper. They may be classed in three sections.

1. The cretaceous or chalk whites, which are unfit for use with oil, but may be employed in distemper.

2. The cretaceous and aluminous whites, which are natural earths, containing chalk and clay, possessing more body than the former, and consequently covering a larger surface. They also work more freely under the brush. They are principally used in distemper, for which they are best suited, but are occasionally employed in oil.

3. The aluminous whites, or pure argillaceous earths, which are used in oil and turpentine, as well as distemper, and cover a larger surface than either of the former. They are much used on the continent as cheap paints for rooms, and retain their colour; but always look poor on wood, even when three or four coats are applied.

BOUGIVAL WHITE.—That pigment called Bougival white is an argillaceous and chalky earth, found at Marly, near Paris, and in many parts of Normandy and Auvergne. It is an excellent colour for painting in distemper, having a much greater body than the pure chalk whites, and is used with greater facility, producing a rich and even surface. The practical painter may assume as a general rule in the selection of whites for distemper painting, that the more pure the argillaceous matter contained in the pigment, the better it will spread under the brush, and the richer will be the surface produced. Bougival white belongs to our second class of earthy pigments, being a combination of argillaceous and cretaceous earths, or, in other words, its component parts are pure clay and chalk.

BRIANÇON WHITE.—Briançon white takes its name from the locality where it is found. It is an earth containing a large portion of pure clay, mixed with carbonate of lime, and sometimes with particles of ferruginous matter. It is prepared for the arts by treating it with vinegar, which dissolves the chalky matter, and the oxide of iron, which is not unfrequently present as an accidental substance, and leaves a pure white clay, which is dried for use. In this state it may be used for oil painting, as it has a tolerably good body, and is not liable to change.

SPANISH WHITE.—Spanish white is a pure clay, and is brought into the market in the form of small rolls, about two inches and a half long, by one inch and a quarter in diameter. When required in a state of great purity, it should be washed in vinegar, to separate the particles of chalk which may be intermixed. It may be used in oil painting, and with varnish; but, before it can be

safely employed in this way, it should be perfectly desiccated. Spanish white is frequently adulterated with chalk. To detect the presence of this substance, place a small portion of it in a glass, and pour upon it a few drops of dilute nitric acid: if the pigment be pure, there will be no effervescence; but if that effect be observed, there is certainly an admixture of chalk, which renders it unfit for all purposes where oil or varnish is employed.

GYP SUM, or SULPHATE OF LIME.—Gypsum is a native sulphate of lime. Its uses in the arts are extensive. After it has been calcined and reduced to powder, it has the property of solidifying again with water, and of retaining the shape of the moulds or vessels in which the solidification takes place. Hence it is used for casting figures, ornaments, and various sculptured decorations for rooms. It combines with wax and oil, and with white lead. A mixture may be made of these ingredients which will rival alabaster in whiteness and transparency. Figures cast hollow in a composition of sulphate of lime, white lead, and wax, and filled, when solid, with sulphate of lime in a creamy state, will retain, for a long period of time, the weight and coldness of marble, and appear more agreeable and mellow to the eye than the natural stone.

The sulphate of lime is also used as a pigment in distemper. When thus employed it is mixed with a large portion of water, and kept in a state of agitation, that there may be the necessary division of particles. Size is then added to give it consistence, and in this state it forms a valuable whitewash for apartments.

SATIN WHITE.—Sulphate of lime is the principal ingredient of a compound colour called satin white. This pigment is prepared from rock lime in the following manner: Eight pounds of rock lime are placed in a pan, capable of containing about eight gallons of water, and upon it that liquid is poured, until the consistency of the lime is destroyed. The pan is then filled with water, and the lime thoroughly mixed with it. When a slight settlement is formed, the liquid is strained through a hair sieve; and the process is repeated until about six gallons of the mixture or milk of lime is obtained. In another vessel, eight pounds of alum are dissolved in six gallons of water, and the two liquids are then mixed, being well agitated with a wooden spatula for the space of half an hour. After an interval of about three hours, the agitation is again commenced. The solution is then allowed to stand for twelve hours, and is fit for use. This white is a compound of sulphate of lime and alumina with

potass in a state of solution. It is called satin white, and is much used by paper-stainers.

MOUDON, or MORAT WHITE.—This pigment is similar in composition to Spanish white, being a pure argillaceous earth. It occurs in the Pays de Vaud, Switzerland, and also at Moudon and Morat, from which places it derives its name. It is used extensively in paper-hanging manufactories; and mixes well with white lead, with which it forms a pearl colour, and the darker greys of considerable lustre.

ROUEN WHITE.—Rouen white is another argillaceous and calcareous earth used in distemper.

THE YELLOWS.

The yellow colours may be divided into three classes. 1. Those deriving their colour from metallic bases, as chrome, Montpellier and Naples yellow, orpiment, massicot, and the ochres. 2. Those receiving their colouring matter from vegetable bases, such as the Dutch pinks, yellow lakes, wood and turmeric lakes. 3. Those derived from animal substances, as gall yellow.

1. The yellows obtained from mineral substances.

MONTPELIER, MINERAL, or PATENT YELLOW.—This colour was for many years under the protection of a patent, and every means was taken to prevent the secret from being known; but its preparation has now become the property of the public. It is a compound of the oxide and chloride of lead. In Gray's Supplement to the Pharmacopœia, we have the following formula: Common salt, one cwt., litharge, four cwts.; these are to be ground in water, at a gentle heat, the loss by evaporation being supplied by occasional additions of water. During this process decomposition takes place. Litharge is a compound of oxygen and lead; common salt is composed of soda and muriatic acid, now termed hydrochloric, which is composed of chlorine and hydrogen. If, therefore, we trace the nature of the decomposition, we shall find that when the oxide of lead is brought into contact with the hydrochlorate of soda, the hydrogen of the acid combines with the oxygen of the oxide, in the proportions which form water; the chlorine disengaged from the hydrogen combines with the lead, and forms a chloride, while the soda, the base of the common salt, remains in solution in a caustic state. When this decomposition is duly formed, and the residue thoroughly

washed from the caustic soda, it is placed in vessels for calcination, and heat is gradually applied, until it assumes a fine yellow colour. This pigment is permanent, and was much used before the discovery of chrome. It is very bright, and possesses much body. If fused, and allowed to cool slowly, it forms beautiful striated crystals, which, viewed in a proper light, are richly resplendent with colour.

NAPLES YELLOW.—The preparation of this colour was for many years kept a profound secret; and the larger quantity of the pigment brought into the market was manufactured by a Neapolitan, from which circumstance it derives its name. In Italy it is called *gialloine*. It is a compound of the oxide of lead, antimony, and zinc. Ure gives the following formula: Twelve parts of metallic antimony are to be calcined in a reverberatory furnace, along with eight parts of red lead, and four parts of the oxide of zinc. These mixed oxides, being well rubbed together, are to be fused, and the mass is to be then broken down into a fine powder. The hue is rich, fresh, and brilliant; but like most other yellows of metallic base, its use has been nearly superseded by that of chrome.

M. Mérimée, in his excellent work on painting in oil, states, that he has received from M. Guimet, the inventor of the artificial ultramarine, a specimen of the yellow of antimony, which has a fine golden tint, more intense than that of Naples yellow. The formula for its preparation is: antimoniate of potass, or diaphoretic antimony, carefully washed, one part; pure minium, two parts. These ingredients must be carefully mixed, and ground upon a marble slab to the consistence of paste, which when dried is reduced to powder, and exposed to a moderate heat, kept within a temperature that will not disengage the oxygen of the lead and antimony, for a period of four or five hours. No doubt is entertained of the durability of this colour.

M. Guimet is of opinion that a colour of equal quality might be produced from the deutoxide of antimony and the oxide of lead, as the potass probably serves no other purpose than that of completely oxidizing the antimony, which is indispensable to the formation of the colour.

IODIDE OF LEAD.—The iodide of lead is a rich and brilliant yellow pigment, but has not yet been employed to any extent in the arts, and the expense which must always attend its manufacture will probably prevent its general use by the house painter. In the higher class of decorations, however, and in works of art, it will probably be found to possess some advantages over other yellows in point

of character. It may be readily formed by projecting iodine on fused lead, and then grinding the produce to an impalpable powder. It may also be made by the union of the nitrate of lead and hydriodate of potass. A double decomposition is the result, causing the formation of water and the nitrate of potass, while the iodide of lead is precipitated as a yellow powder. This chemical change may be made evident by a brief description. The nitrate of lead is formed of lead and nitric acid, and the latter is composed of oxygen and nitrogen. The hydriodate of potass is composed of hydriodic acid, which consists of hydrogen and iodine, and potassium in the state of an oxide. Now, when these substances are united, the oxygen and nitrogen of the nitric acid combine with the oxygen and potassium, forming nitrate of potass; the iodine of the hydriodic acid combines with the lead, and forms iodide of lead; while the hydrogen of the hydriodic acid unites with the oxygen of the lead, and forms water. This is an interesting example of the mutual decomposition of substances, and the production of new compounds by the action of chemical affinities; and will explain to the reader, the principles by which the chemist is able to ascertain the effects that will be produced by the union of two or more compound substances, by a knowledge of their affinities, and the proportions in which they unite.

CHROME YELLOW.—The rich pigment known in commerce as chrome yellow, is a chromate of lead. This substance is, as its name imports, a chemical combination of lead with chromic acid. Now, before we attempt to explain the nature, physical properties, and uses of this compound, it will be necessary that the chemical characteristics of the substances from which it is procured should be thoroughly understood.

Chromate of iron is the mineral from which chromium, the oxides of chrome, and the chromates, are most readily and economically procured. It is a natural salt of iron, and is found in considerable quantities in a rock called serpentine, on the Cari hills near Baltimore, at Portsoy in Banffshire, and in the islands of Unst and Fetlar in Scotland. Its constituent parts, according to Haiiy, are, oxide of iron 34.7, oxide of chrome 43, alumina 20.3, and silica 2. Another variety of the chromate of iron is found in Siberia, and consists, according to the analysis of Laugeir, of oxide of iron 34, oxide of chrome 53, alumina 11, silica 1, and 1 of manganese.

Chromium exists in nature combined with many other substances besides iron. It is found in a mineral called the red lead ore of Siberia. It has also been detected in the emerald; indeed, it is to the presence of the oxide of chrome that

the gem owes its resplendent colour. In various aërolites, or meteoric stones, it has also been detected.

Vauquelin, an eminent French chemist, was the discoverer of chromium and most of its combinations. He was first led to suspect the presence of this then unknown substance in an aërolite, but did not at the time accurately define its characters. Being subsequently engaged in the analysis of the emerald, he again met with results similar in many respects to those he had before observed when analyzing the meteoric stone. This caused him to investigate more accurately the origin of these appearances, and he at last discovered that the emerald owed its colour to the oxide of a new metal, to which he assigned the name chromium, from the Greek word *χρῶμος*, colour.

Chromium has not yet been found native in a metallic state. It is a metal which has a great affinity for oxygen, with which it combines in various proportions, forming oxides. Its first combination is the protoxide, composed, according to Berzelius, of chromium, 100, and oxygen, 42.633, which being reduced to his atomic numbers is represented by 351.82 of the metal + 150 oxygen = 501.82 . Of this substance, which is very important in manufactures, we shall have occasion to speak more fully when describing the green colours. The deutoxide of chromium, which is the next combination of the metal with oxygen, is a brilliant brown powder, and, according to Berzelius, is formed of 100 metal + 56.84 oxygen, and by his formulæ appears to consist of two atoms of chromium = $351.82 \times 2 = 703.64$ + 4 oxygen = 400 .

The third combination of chromium and oxygen is termed the tritoxide. It combines with most of the salifiable bases, and forms a genus of salts termed chromates. Berzelius gives its prime equivalent 6.5 , which consists of 3.5 chromium, and 3.0 oxygen.

Having examined the nature of chromium, and its combinations with oxygen, and having found that the tritoxide acts as an acid, combines with various bases, and forms the salts termed chromates, we must now proceed to investigate the most important of its combinations, or at least those which have relation to the manufacture of colours.

The salt which first claims our attention is the chromate of potass, a combination of chromic acid and potass, which unite in the following proportions: chromic acid 6.5 , potash $6 = 12.5$. This salt is capable of crystallization, and assumes the form of a four-sided prism terminated by dihedral summits; its colour is a bright yellow, and its taste cooling and metallic. Water, at a temperature of 60 degrees, dissolves about half its weight of this salt, and boiling water considerably

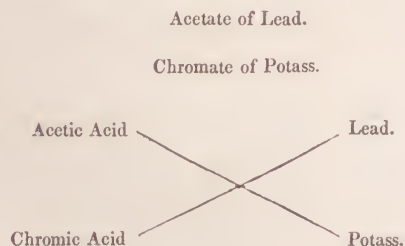
more. Chromium and potass also unite in another proportion, forming a salt which is called the bi-chromate of potass, which is formed of 13 of chromic acid and 6 of potass. The crystals of the bi-chromate of potass are of an exceedingly beautiful dark orange colour, formed in square tables with bevelled edges, a flat, four-sided prism. It may be easily produced by adding diluted nitric acid to a concentrated solution of the chromate of potass. An orange precipitate will be formed, which dissolves when the temperature of the liquor is raised, and on cooling crystallizes in the forms above described. This salt is remarkable for the regularity and boldness of its crystals, as well as the splendour of its colour, and elegant and pleasing ornaments may be formed of it if crystallized on shapes. It is from this salt we obtain, in the readiest manner, the useful pigment called chrome yellow.

The reader will now be prepared to understand the manufacture of this salt on a large scale. A quantity of the best chromate of iron must be first obtained; and it is worthy of remark that the variety which is richest in chrome may be distinguished by the uneven vitreous appearance it presents when broken, and by its somewhat metallic lustre. Its colour is between steel grey and iron black; but if looked at in an oblique position it should have a violet bronze hue, which indicates its richness. Those pieces which appear slaty and dull should be rejected, as the use of them would not recompense the chemist for the manufacture of the bi-chromate of potass, the salt he is supposed to require. The chromate of iron being suitably chosen, must be reduced to a fine powder and sifted, and afterwards mixed with about one third of its weight of the nitrate of potass, which is the saltpetre of commerce. The perfect mixture of these substances is a matter of great importance, for the decomposition which is required would otherwise be only partial, and a great loss of time, of expense, and of product would ensue. Having proceeded thus far, a number of common earthenware flower pots are filled with the mixture, and are severally inverted in pairs, one on the top of the other. These pots are then carefully packed in rows, generally about six in breadth and the same number in depth, making a square of four-and-twenty. An equal number are then piled upon the top of these, and so on until the furnace is filled with the requisite number of pots. A layer of charcoal is placed on the movable bars of a convenient furnace, and on this the pots are carefully packed. The front is then closed with bricks and loan, and the furnace is charged from the top with small coke. The iron chimney being luted on, the charcoal is ignited at the draught hole, and the heat is speedily communicated to the coke, so that in a short time the whole is brought to an

intense heat. The damper is opened or shut according to circumstances, so as to secure a proper temperature, which should be continued for about six hours. When sufficiently cold, the pots are taken out of the furnace, and their contents removed. The substance thus produced consists of chromate of potass, oxide of iron, alumina, and silex.

The next process is to extract the chromate of potass, which is done in the following manner: The masses removed from the pots are first roughly powdered, and lixiviated with hot water, until no tinge of yellow can be observed. The lixiviations are concentrated by evaporation, and on cooling, yellow crystals of the chromate of potass are formed. The method of procuring the bi-chromate has been already explained.

The chromate of potass being obtained, the chromate of lead is easily prepared; for it is the result of a double decomposition, which cannot fail to be effected when the substances are presented to each other. A perfectly clear and pure solution of the acetate of lead is poured, by degrees, into a clear solution of chromate of potass; and to secure the perfect mixture of the two substances, they are kept for some time in a state of agitation. A fine yellow precipitate is immediately thrown down, and this is the chromate of lead; the acetic and chromic acids having exchanged bases, the acetic acid of the lead combining with the potass, and the chromic acid combining with the lead, so that by this mutual decomposition two new compounds are formed, viz., acetate of potass, and chromate of lead, as shown in the following table:



The samples of chrome yellow brought into the market vary greatly in intensity and in hue, presenting all the various tints from a deep orange to a pale canary, and are accordingly distinguished in commerce. Those varieties which have a reddish yellow or deep orange, colour are nearly pure chromates of lead, or are mixed with the bi-chromate of lead; those hues which have a less intensity contain a large proportion of the carbonate of lead, while those which have a

canary colour are chiefly composed of it, with a slight admixture of the chromate of the same metal. The bi-chromate of lead may be formed by boiling a solution of chromate of potass on carbonate of lead, a constant agitation being kept up. It is of a full red colour, and has great body.

We cannot leave this subject without noticing the extraordinary directions for the manufacture of the chromate of lead, in a work which bears the name of Professor Tingry of Geneva. The student is there told to commence his operations by dissolving two pounds of the chromate of iron in water. Many have, we do not doubt, made the attempt, and all, we are sure, have failed, for it is a substance which is insoluble in water.

It is scarcely to be supposed that such a direction could have been given by a chemist so eminent as Professor Tingry, but is, probably, the emendation of some ignorant or careless person, who has taken upon himself the task of making "additions and improvements."

It is worthy of notice, that the hue of the chromate of lead will vary from a fine clear yellow to that of an orange, according to the temperature of the water in which the precipitate is made. The finest yellows are generally produced from the nitrate of lead. The lighter shades may be obtained by mixing a solution of alum or sulphuric acid with the chromate of potass, before it is added to the solution of lead. The orange colours are best obtained when the chromate of potass is in the neutral state, or that of a subchromate.

The chrome yellow is not considered to be a permanent colour, and the greater the proportion of oxide of lead contained in it, the less the probability of its remaining unchanged. By the admixture of alumina, however, it is rendered far more permanent.

The introduction of the chrome yellow as a colour in house painting has been attended with many advantages. Before this colour was known, the ochres were chiefly employed, which are not only inferior in tint, but much larger quantities are required to produce the same effect. Many of our readers will remember the time when one or two men were constantly employed by the tradesman in grinding ochres, and preparing other materials, which are now delivered into his hands by the manufacturer fit for immediate use. These advantages have been derived from the successful application of chemistry to the production of new colours, and the improvement of those before known. Nor is it to be forgotten that, while these improvements have been made, cheapness has also been an object, so that, as is well known to the house painter, a penny expended for the chrome yellow will do as much work as a shilling's worth of ochre.

THE OCHRES.—The ochres are natural productions, being found in mineral masses, frequently several feet in thickness, and chiefly consist of argillaceous matter coloured by iron, in various states of combination. The iron generally appears as a hydrate, or, in other words, as an oxide combined with water. When the ochres are analyzed, they are commonly found to consist of alumina and silica, with the colouring matter, and sometimes a trace of magnesia. They vary in colour from a pale, sandy yellow to a brownish red; but the greater the proportion of clay the brighter will be the colour. To prepare them for the use of the painter, they are ground under millstones, and the finer parts are separated from the grosser by washing. Spanish brown, Indian red, Venetian red, and the yellow ochres, have nearly the same composition, the difference of colour arising from the state in which the iron is combined with the other constituent parts. The red varieties are coloured by the peroxide or carbonate of iron. The yellow ochres become red when calcined; but the finest reds are made from those which are brown in the bed.

The ochres are, in commerce, divided into two classes, the yellow and the red. We have thought it desirable, for the assistance of the painter, to form a classification in this chapter, founded upon the colours, and not upon the bases of pigments; and although there is but little difference in the composition of the ochres of different colours, it will be desirable to retain this arrangement, which may be done without invading the unity of the subject.

The yellow ochres are principally used as distemper colours, though some of them have been extensively employed in oil painting, and are still preferred to all other colours for the imitation of wainseot and some light woods. The several varieties of ochre are distinguished by different names, such as the Dutch, English, Bristol, and Oxford.

Umbre.—The name umbre, given to a variety of ochre, is derived from Umbria, a place in Italy, where it is found; the best specimens of this substance, however, are brought from Turkey and the island of Cyprus. It is said to contain manganese, as well as argillaceous earth and iron.

ORPIMENT.—This is a pigment which is found perfectly formed in its native state, generally crystallized in oblique, rhomboidal prisms. That variety called golden orpiment is chiefly brought from Persia, in yellow masses of lamellar texture, and possessing great brilliance. It is composed of sulphur and arsenic, and was known to the Romans, who called it auripigmentum, of which its present name is a corruption. Much of that brought into the market is manufactured.

In Saxony it has been made in large quantities. A due proportion of sulphur and arsenic are placed in an iron vessel, mounted with a conical head, and the mixture is sublimed. Thus prepared, it is found in masses of a glassy appearance, of a lemon colour.

SULPHURET OF CADMIUM.—This pigment resembles orpiment in its colour. It may be obtained by precipitating a solution of cadmium with sulphuretted hydrogen gas, or an alkaline hydrosulphuret. It is said that the colour may be used without fear of any change, which will greatly recommend it to the artist, if this statement be found correct. Orpiment cannot be used with any pigment which has lead for its base, for the sulphur which is in combination with the arsenic has less affinity for that metal than for lead, so that, when these substances are brought into contact, a sulphuret of lead is formed, which is, as already stated, of a dark, greyish colour. The same, we fear, would be the result if the sulphuret of cadmium and a preparation of lead were used together. This fact detracts from the value of the pigment; but it is still useful, and can be employed for many purposes, its peculiar character being borne in mind.

II. The Yellows obtained from Vegetable Matter.

Many vegetable substances, such as turmeric, woad, and French berries, have the property of giving their colouring matter to chalky and aluminous earths. These pigments are various in hue, shade, and brilliancy, and are very important in nearly all applications of the art of colouring. Some are fugacious; but there are others which resist the action of light, and heat at ordinary temperatures, for a considerable period of time. We shall endeavour to describe the preparation and uses of the most important of these colours.

INDIAN YELLOW.—This pigment is prepared from the colouring matter of a large shrub, called memecylon tinctorum, a native of Bengal. It is manufactured at Calcutta, and is a brilliant yellow lake of considerable durability.

GAMBOGE.—This substance is a gum resin, and is imported into Europe from the East Indies. It has long been used as a water colour, and is found to have considerable durability. There is some difficulty in making it miscible in oils, but this is done, and by some artists it is used, although common opinion is decidedly against it, as it is supposed to darken with age. It is, however, exten-

sively employed in lacquering, and by gilders in colouring their size. It dissolves in spirits of wine, forming a deep, orange red solution. In this state it stains marble of a beautiful citron yellow colour. The extract of gamboge is the gamboge precipitated from the spirituous solution by the addition of water.

THE YELLOW LAKES.—The yellow lakes are tinctures of vegetable substances, combined with aluminous or calcareous earth as a base. Their characters differ according to the nature of the vegetable matter employed as the colouring substance. Turmeric yields a colour which is very fugacious. It is prepared by treating the root with a solution of soda or potass; the solution is then filtered, and a solution of alum is added as long as any precipitate falls: the liquid being poured off, the precipitate is washed, and formed into small pyramidal buttons by pressing it, in a pasty state, through the stem of a funnel, with a piece of stick. This colour is much used in distemper and in paper staining. Excellent yellow lakes are made from quercitron bark and broom flower. Of the other yellow lakes it is not necessary to speak, as they are all formed in nearly the same manner. It may be worthy of remark that if a solution of tin be employed in the manufacture of the yellow lakes, the colour will incline to a lemon hue, and when the acetate of copper is employed, a greenish hue will be obtained.

THE BLUES.

The blues are an interesting class of colours; for the manufacturer has succeeded in producing them with an extraordinary degree of richness and intensity. They are not very numerous, and can be easily produced in small quantities by the student; a course of study we should strongly recommend to all who are anxious for an acquaintance with the manufacture of colours, for it will be found that more information will be derived from a series of experiments than from many books.

THENARD'S, or COBALT BLUE.—Many of the mineral blues are exceedingly rich, but none are more important to the painter than those which derive their colour from cobalt. This metal does not receive its name from any known property, but from an old German superstition. The miners of that country believe in the existence of a demon of the mines, whom they call Cobalus. It was the pleasure and business of this fiend to thwart the efforts of the miners. and among other freaks he was supposed to throw down large masses of a mystical and intractable ore, for the purpose of creating impediments, and of preventing

them from the acquisition of more valuable substances. To this mineral they consequently gave the name cobalt, and so little were the properties of the now valuable metal known, and so little was it esteemed, that it was employed for mending the roads in the neighbourhood of the mines.

In the year 1802, M. Thenard was desired by Count Chaptal, then Minister of the Interior, to direct his attention to such investigations as might tend to improve the manufacture of colour. Among other important discoveries, he succeeded in forming a beautiful blue colour from the combination of the phosphate of cobalt and alumina, which still bears his name. The following formula is given by its inventor for its manufacture: To a solution of the phosphate of soda, add a solution of the nitrate of cobalt, and a mutual decomposition will follow, the nitrate of soda in solution, and the phosphate of cobalt as a precipitate. Let this precipitate be then mixed with eight times its weight of gelatinous alumina, after which spread the compound in thin layers on plates, and when dry reduce it to powder. When it has been exposed to a red heat for half an hour in a covered crucible, it will on cooling possess a brilliance of colouring almost equal to ultramarine. If the colour should not have a sufficiently vivid hue, it denotes that a portion of the oxygen from the cobalt has been driven off. To correct this fault, reduce it again to powder, and mixing with it a small portion of the tritoxide or red oxide of mercury, submit it to the action of a strong heat. It may be desirable to state, that the gelatinous alumina is prepared by precipitating a solution of alum with carbonate of soda.

The cobalt blue is a beautiful colour, and in permanence only inferior to the ultramarine. It works well both in water and in oil.

SMALT.—Smalt is a beautiful blue pigment, frequently possessing a richness and lustre of hue little inferior to ultramarine. It consists of glass stained by the oxide of cobalt, and afterwards ground to an impalpable powder. In the improved methods of manufacture, the silicate of cobalt is used for staining glass, and also for painting on earthenware. It may be formed by double decomposition from the silicate of copper and sulphate of cobalt. To form the sulphate of cobalt, take the common cobalt ore, and roast it gradually until it cease to give off fumes; an impure, black oxide will remain. Mix this substance with concentrated sulphuric acid, and form it into a paste. Then expose it to a moderate heat, and raise the temperature gradually until it is at a cherry red, in which state it must be kept for about an hour. The sulphate thus obtained must be powdered, dissolved in water, and filtered. A solution of the carbonate of potass

must then be gradually added to separate any remaining portion of the oxide of iron, and the remaining solution will contain the sulphate of cobalt.

The silicate of potass is prepared in the following manner: Ten parts of potass are carefully mixed with fifteen parts of finely ground flints or sand, and one part of powdered charcoal. The mixture is melted in a crucible of brick clay, an operation which requires steady ignition for five or six hours. The mass when melted and pulverized may be easily dissolved in boiling water, by adding a little at a time of the glass, which should be previously ground. The filtered solution is colourless.

The precipitate formed by the mixture of the two solutions is the silicate of cobalt, a substance admirably suited for painting on porcelain.

EGYPTIAN AZURE.—In the Philosophical Transactions for 1815, Sir Humphry Davy has described the composition of a colour which he calls Egyptian azure. It may be produced by the following process: Take fifteen parts by weight of carbonate of soda, twenty of powdered opaque flints, and three of copper filings. These must be heated together in a strong fire for about two hours. The mass when powdered produces a fine deep sky blue, similar to the blue used by the ancient artists of Egypt and Italy. It is generally supposed to be a permanent colour, and to be fit for use either in distemper or oil; but some artists doubt the propriety of employing it with oil. It derives its name from the colour employed by the Egyptians on the walls of their temples, and on the mummy cases. Count Chaptal discovered it in a shop at Pompeii. The Egyptian blue of modern times has not the permanence of character of that manufactured by the ancients. It is said that a great improvement has been made in the manufacture of this colour, by mixing powdered glass, coloured by copper green, with nitrate of potass, and then submitting it to a strong heat, but of a temperature not sufficient to melt it. The colour thus produced is a brilliant light blue; but if the substances should be combined by fusion, a green colour would be produced.

VERDITER.—The blue verditer is supposed to be made from a mineral called the lapis armenus, found in the Hungarian mountains; but the larger quantity of that sold in the market is a preparation of chalk coloured with copper, and is utterly useless. This factitious pigment is formed by adding nitrate of copper in solution to a solution of pure lime. By the mixture of these two substances, a blue precipitate is thrown down, and this, when dried, is ground with lime, and sold as blue verditer. It is sometimes used by the house painter; but it is unfit

for use in any situation where a permanent colour is required. The verditer obtained from the mineral already mentioned does not retain its colour, but frequently assumes a greenish hue both in oil and water.

M. Pelletier has given, in the *Annales de Chimie*,* several processes for the manufacture of blue verditer; but the one we have described is preferable to any other. The beauty and intensity of the colour depend upon the judicious admixture of the quick lime and the precipitate. As a distemper colour for inferior work, it may be employed with advantage as a cheap pigment, but is quite unfit for use as an oil colour.

ULTRAMARINE.—This colour is so brilliant, that any attempt to describe it would fail, for no phraseology can give an idea of its peculiar refulgence. In the presence of all other blues, it seems to be possessed of an internal fire, and glows with a radiance which mocks every other colour. The purer sorts of ultramarine have a positive redness, which, however, does not appear in the body itself, but seems to radiate around it, and is probably caused by some peculiar action of the colour upon the retina of the eye. This is still more extraordinary when we consider its composition; for it is found to consist of alumina, silice, soda, and sulphur, and, therefore, is not even a metallic compound, unless the sulphur be in combination with the metallic bases of the earths we have named, forming sulphurets of those metalloids.

Ultramarine is produced from a mineral called lapis lazuli, or lazulite, a stone found in China, Persia, and Great Bucharía. It is a variegated blue mineral, and has white and gold coloured veins like some marbles, and bears a high polish. According to Klaproth, it consists of 46 parts of silica, 14.5 of alumina, 28 of carbonate of lime, 6.5 of lime, 3 of oxide of iron, and 2 of water. But according to the analysis of MM. Clement and Desormes, it consists of silica 34, alumina 33, sulphur 3, soda 22. Iron, carbonate of lime, and other substances, were detected by these chemists, but were not supposed to enter into combination with the other minerals as component parts, but to be accidentally mixed.

From the lazulite the ultramarine is prepared in the following manner: The stone is first broken to pieces, and the white veins are separated as much as possible. Those parts which have the finest colour are then collected, and being brought to a red heat in a crucible are thrown into cold water. The stone being thus prepared for grinding, the fragments are removed from the water, and reduced to an impalpable powder in an iron mortar. It is then passed through a fine

* Vol. XIII. p. 47.

sieve, and ground with water upon a porphyry slab. When dry, the powder thus produced is incorporated with a resinous compound formed of 40 parts of rosin, 20 of white wax, 25 of linseed oil, and 15 of Burgundy pitch. The powder and resinous compound are united in such proportions that a pliant paste is produced. These substances being united by heat are poured when in a melted state into cold water, and well kneaded, and when formed into rolls, are removed to another vessel of cold water, where they remain about a fortnight. The paste is then pressed in a close vessel of water, and the blue powder of the lazulite being separated falls to the bottom of the vessel. This process is continued in fresh water as long as any colour can be extracted; but the colour first obtained is of course the most brilliant and most valuable. The powders thus procured are then thoroughly washed in successive waters to remove any impurities, and especially any portion of resinous matter; they are then digested in alcohol, and should there be any reason to believe that any portion still remains, it may be removed by digestion with ether.

When no more colour can be abstracted by the use of cold water, the resinous mass is slightly alkalisied with soda, at a temperature of about a hundred and fifty degrees, and colour is again produced; but the powder thus obtained is much inferior to that collected by former processes. This is called in commerce, ultramarine ashes.

The ultramarine of commerce is frequently adulterated with cobalt or Prussian blue; but it is easy to ascertain whether any specimen presented for sale be pure; for although it can bear a red heat without losing its rich hue, the application of acids is instantly followed by a deprivation of all colour. To test the purity of this substance, it is, therefore, only necessary to throw upon it a small quantity of nitre, and if it be unadulterated, the colour will be destroyed, and a yellowish-grey, earthy matter will be left.

It was long supposed that the rich colour of the ultramarine was occasioned by the presence of iron; but MM. Clement and Desormes, in their experiments, succeeded in producing ultramarine in which iron was not found.

In consequence of a premium of 6000 francs, offered in France by the Society for Promoting Discussions in Science, for a process of making an artificial ultramarine, equal to that produced from the lazulite, the attention of chemists was drawn to the subject, and the work has been successfully accomplished by M. Guimet, who has received the prize, and at the same time by M. Gmelin, who has published his process in the *Annales de Chimie*.* This process has

* Tome XXXVII. p. 411.

been tested by many eminent chemists, and has been spoken of as one by which an ultramarine scarcely inferior to that of the lazulite can be obtained, although some modifications are thought desirable by the manufacturer.

PRUSSIAN BLUE.—This pigment is a compound of Prussic acid, potass, and iron. It is of a dark, intense, and clear blue colour, and may be readily produced by decomposing the prussiate of potass with a salt of iron, generally the sulphate. It is extensively employed in the arts; but although a powerful colour, is inferior in permanence, as in all other qualities, to ultramarine, and becomes darker in both oil and water.

Prussian blue was discovered in the year 1704 by accident. One Diesbach, a manufacturer, when precipitating a solution of alum to obtain a white powder as a base for lake, used some potass given to him by Dippel, by whom it had been rectified with animal oil, and, instead of producing a white precipitate, collected one that was blue. Dippel being informed of this result, commenced an examination of the cause, and at last succeeded in the manufacture of Prussian blue; but the process was for a long time kept secret. In the year 1724, it was discovered by Woodward, and by him made known to the public.

The Prussian blue is manufactured in the following manner: The first step in the process is to manufacture the prussiate of potass, which is done by fusing the potass of commerce with blood or some other refuse of animal substance; equal parts of potass and dried blood are generally thought preferable. When these are thoroughly mixed by fusion, in pots prepared for the purpose, being brought to a red heat and pasty consistence, the mass is removed from the pots and allowed to cool. About eight parts of water are then poured on the fused matter, and the solution, when filtered, will be of a yellow colour, and is an impure solution of the prussiate of potass. Another solution is then formed, for which two parts of alum and one of sulphate of iron are employed. These are dissolved in about eight or ten parts of water, and the mixture is filtered or allowed to settle. On mixing these two solutions together, a double decomposition ensues; the iron combines with the prussic acid of the prussiate of potass, and the sulphuric acid of the sulphate of iron combines with the potass of the prussiate, forming a sulphate of potass, while the prussiate of iron, or Prussian blue, is thrown down, the sulphate of potass being held in solution. On the other hand, a similar decomposition occurs with the alum, and the superabundant carbonate of potass existing mixed with the solution of the prussiate of potass. By this means, a sulphate of potass is formed, and the alumina or base of the

alum is precipitated. These two precipitates, prussiate of iron and alumina, being produced at the same instant of time, are intimately mixed, and together form a substance of a brilliant and intense blue colour, which is the Prussian blue of commerce: and which, when washed and dried, is fit for the use of the painter. In purchasing Prussian blue, the painter will find the advantage of knowing that it should be light in the hand, and adhere to the tongue. It is, like all other pigments, much adulterated by the manufacturer. If it effervesce when touched with an acid, chalk has been introduced; if it become pasty in boiling water, it has been adulterated with starch. The finer sorts, when rubbed gently by a polished surface, present a reddish hue, approaching to the colour of copper, and have a metallic lustre.

BLUE ASHES.—This pigment is a hydrated carbonate of copper, and is used in decorative painting, but is by no means permanent. The first process in the preparation of this colour is the precipitation of a solution of copper by the carbonate of potass. To effect this, some care is required; for if the temperature be too high, the precipitate will be crystallized, and if too low, pale and pasty. In this manner a carbonate of copper is formed, which will be of a green colour. The next process is to convert it into the blue pigment. To effect this, take two pounds of good quicklime, and having slaked it, and brought it to the consistence of milk, add ten ounces of sal ammoniac in a state of powder, and mix them thoroughly by stirring. This must be allowed to stand until it has cooled, when about four and twenty pounds of the carbonate of copper should be added. The mixture must then stand for a day, and the precipitate may be washed and dried. The temperature of the compound during the operation is of the greatest importance; for, should it be raised too high, the hydrate would be decomposed, and a black oxide be formed.

THE REDS.

Having explained the manufacture of the yellow and blue colours, we have next, in following out our design of taking the primitive before the secondary colours, to consider the several varieties of the red pigments brought into the market for the use of the artists. These are produced from mineral, vegetable, and animal substances, and will be described under two classes, first, those which derive their colouring matter from mineral substances, and secondly, those which are obtained from vegetable or animal matter.

1. *The Reds obtained from Mineral Substances.*

CINNABAR, or VERMILION.—Cinnabar is a native red sulphuret of mercury, and has a bright scarlet colour. It is found in the quicksilver mines of Hungary, Saxony, Bavaria, and Almaden in Spain, it is also brought from China, Japan, and Mexico.

The same substance, when produced by artificial means, is called vermilion, and is extensively used in the manufacture of sealing wax, and in small quantities as a pigment. It is formed, by gradually adding to one part of sulphur, five or six parts of mercury. This mixture takes a blackish hue, and is called ethiops, or the black sulphuret of mercury; but when reduced to powder and sublimed, it becomes a brownish red crystallized mass, which is the bisulphuret of mercury. When reduced to a powder, it assumes a scarlet colour. Upon the application of a moderate heat, it will evaporate without leaving a residuum, a fact which will be found useful in an attempt to ascertain whether it has been adulterated by red lead.

This method of producing vermilion is exceedingly simple, but it has been found that when it is reduced to a fine powder by grinding, something more is required to give it that bright tone possessed by the Chinese vermilion. What this process should be is not to the present moment decided. Some manufacturers grind the powder with urine, and then boil it for a considerable time. Some treat it with nitric acid—and thus, for want of a precise information as to the change to be produced, each person adopts some favourite method of his own.

The Dutch have been long celebrated for the superiority of the vermilion manufactured by them, and notwithstanding every attempt which has been made to produce a substance of equal colour by other nations, especially the French, it is scarcely to be denied that their manufacture is to be preferred. It may therefore be interesting to state the process said to be adopted in Holland, as published by M. Tuckert, apothecary to the Dutch Court, in one of the early volumes of the *Annales de Chimie*.

“The establishment in which I saw, several times, the fabrication of sublimed sulphuret of mercury, was that of Mr. Brand at Amsterdam, beyond the gate of Utrecht; it is one of the most considerable in Holland, producing annually from three furnaces, by means of four workmen, 48,000 pounds of cinnabar, beside other mercurial preparations. The following process is pursued here:—The ethiops is first prepared by mixing together 150 pounds of sulphur with 1080 pounds of pure mercury, and exposing this mixture to a red heat in a flat polished iron pot, one foot deep, and two feet and a half in diameter. It never takes fire,

provided the workman understands his business. The black sulphuret, thus prepared, is ground, to facilitate the filling with it of small earthen bottles capable of holding about twenty-four ounces of water; and thirty or forty of these bottles are filled beforehand to be ready when wanted. Three large subliming pots or vessels, made of very pure clay and sand, are previously coated over with a proper lute, and allowed to dry slowly. These pots are set upon three furnaces bound with iron hoops, and they are covered with a kind of iron dome. The furnaces are constructed so that the flame may freely circulate and play upon the pots, over two thirds of their height. The subliming pots having been set in their places, a moderate fire is kindled in the evening, which is gradually augmented until the pots become red. A bottle of the black sulphuret is then poured into the first of the series, next into the second and third, in succession; but eventually, two, three, or even more bottles may be emptied in at once; this circumstance depends on the stronger or weaker combustion of the sulphuret of mercury thus projected. After its introduction, the flame rises four and sometimes six feet high; when it has diminished a little, the vessels are covered with a plate of iron, a foot square, and an inch and a half thick, made to fit perfectly close. In this manner, the whole materials which have been prepared, are introduced in the course of thirty-four hours into the three pots; being for each pot three hundred and sixty pounds of mercury and fifty of sulphur; in all four hundred and ten pounds."

During the process of sublimation, the mass is stirred about every quarter of an hour. When the process is complete, the pots are broken to pieces, to remove the vermilion encrusted upon them, generally amounting to about four hundred pounds, so that there is a loss of about sixty pounds on each vessel. The lumps are then ground with water between horizontal stones, and the paste is pressed through sieves and dried. The rich tone of the Chinese vermilion is obtained, by adding, before sublimation, one per cent of the sulphuret of antimony, and by digesting the product, when ground, first in a solution of the sulphuret of potass, and then in diluted muriatic acid.

A fine vermilion, it is said, has been obtained by Bucholz, by digesting in a sand bath one part of sulphur with three parts of mercury, in six pints of water, adding potass as may be required. The longer the heat is continued, the more strong will be the carmine tint of the pigment. When the colour required has been produced, the vermilion is thrown into a vessel of water and washed, till all the sulphuret of potass is removed.

As the mercurial vapour is exceedingly injurious to the workmen, every precaution should be taken in the construction of the shops, to secure a perfect ventilation. A good current of air to the chimney, is of the utmost importance. To prevent the workman from inhaling the vapour over the fire, it is desirable to fit the glass rod with which the mixture is stirred to a long staff, and to add the potass with a spoon of sufficient length to keep him away from the rising vapour.

Vermilion is a valuable pigment, being, when pure, bright and permanent. It is, however, too commonly adulterated with red lead, and ought, in all cases, to be tested, which is best done by the application of heat, before it is used by artists in works intended to outlive the passing day. The pure colour has a more crimson tint than that which has been adulterated.

PERIODIDE OF MERCURY has a scarlet colour, brighter than vermilion. It is chiefly used in water colour painting, and is frequently called geranium red. It is made from the iodide of zinc. To form this substance, place some finely powdered zinc with iodine and distilled water in a matrass, and by a gentle heat the iodine will be united to the mercury, forming an iodide of that metal. To this add a solution of the perchloride of mercury, and a bright coloured precipitate will be immediately thrown down, which is the perchloride of mercury. This powder being well washed is fit for use. It is a vivid scarlet colour, but is not durable, and cannot be trusted. Mr. Fielding says, that "in tint it is almost too vivid for agreement with other colours, and the artist will do well to avoid it, until a more certain preparation can be made."

THE RED OCHRES, or RED OXIDES OF IRON.—The red ochres differ but little from the yellow in chemical composition; indeed, the former are chiefly made by calcining the latter. The nature of the change is well exhibited in the rust of iron, which has first a yellow tint, but assumes a reddish hue upon exposure to the air. The red ochres, which are more properly of a brown red colour, are also found native, especially in ancient volcanic districts; and these are prepared, like the yellows, by grinding and lixiviation. Rich and beautiful varieties are found in Auvergne, in the South of France. They also occur in districts which cannot be strictly called volcanic, and are found in various parts of England, especially on the Mendip hills and in some localities of Monmouthshire. It will be desirable to mention one or two varieties of the red ochres of commerce.

Indian Red, or Persian Ochre.—This pigment varies greatly in tint, but is always more or less purple. It is a permanent colour, both in water and oil, but is too expensive for general use in house painting. In the Transactions of the Society of Arts, (vol. 46,) an account is given of a red earth sold at Quebec, at threepence per pound, which is said to be quite equal to Indian red. It is obtained from the Magdalen island, in the Gulf of St. Lawrence.

Venetian Red.—The Venetian red is obtained in the neighbourhood of Venice, from which circumstance it derives its name. It is composed of argillaceous earth and oxide of iron. It is a permanent and useful colour.

Terra de Sienna.—This pigment is brought from Sienna in Italy. It is a beautiful brown orange colour, and very transparent when applied in painting, which quality it retains after it has been burned, although it then assumes a redder hue. It is used by the grainer in his imitations of mahogany, and is employed by the artist in water colours to produce the autumnal tints. With blue it forms a faded green.

An Artificial Red Ochre.—We may here mention an artificial ochre which may be manufactured from iron. If the peroxide of iron, which is formed by the distillation of the sulphate, be gradually heated until it is brought to a great intensity of temperature, its full red colour will be augmented in richness, inclining to purple; and a hue will be produced very similar to that of the Persian ochre, and equally bright, if properly calcined and washed. The brown ochre may be formed by precipitating iron in a state of solution by the subcarbonate of soda, or muriate of potass. This is an important and lasting colour, and is supposed to have been much used by Titian, Vandyke, and other old masters. Mixed with white it forms a fine carnation tint.

There are many other varieties of red ochre, among which we might especially mention the Light Red, which is made by calcining a yellow or brown ochre, and is an exceedingly useful colour both in water and oil, being permanent and drying well; but it would be useless to even enumerate all the kinds which are brought into the market.

REALGAR, OR RED ORPIMENT.—This pigment differs chemically from orpiment, which has been already described, in the proportion of sulphur. In volcanic districts it is sometimes found native, but that which is brought into the market is made by subliming orpiment and sulphur. In the mass it is of a bright scarlet colour, but when levigated it assumes an orange red tint.

This colour is not considered to have a requisite degree of permanence, and is but little used by artists.

II. The Reds obtained from Animal and Vegetable Substances.

The pigments which consist of a colouring matter, derived from animal or vegetable substances, combined with an earthy base, are known by the general term lakes. The word seems to have been derived from lac, the substance from which this class of colours was first made. The word lake when used in a limited sense, may be said to signify that class of colours more commonly known as crimsons, but in its more general application it includes all colours of an animal or vegetable origin, united to an earthy base. Some are green, some yellow, and others red; the last mentioned are the most abundant, and to them we shall in this place principally refer.

In the manufacture of the lakes the formation of the white body is to be first considered. It usually consists of a pure alumina, but a mixture of alumina and chalk is sometimes employed. A simple mode is to dissolve alum in a solution of the colouring matter. The precipitate is then formed by the addition of soda or potass, the former is to be preferred. Care must be taken that the alkali be not in excess, for a purplish hue will be given to the reds, and the yellows will become orange or brown.

All the lakes, except the madders, may be said to want permanence. The inferior lakes are made from Brazil wood, but a very rich and bright colour may be obtained from this substance by the addition of ammonia. M. Mérimée is of opinion that Titian used this colour in the drapery of Joseph of Arimathea, in the picture of the Entombing of Christ. Lac lake is more permanent than that obtained from cochineal, and is supposed to have been used by many of the ancient masters. A very bright scarlet lake is made by the addition of vermilion to cochineal, but it is one of the least permanent colours, as may be supposed from the known effect of lead on the cochineal dye. The kermes has been used in dyeing purple and crimson, and many pieces of tapestry prepared with this colour still retain much of their original brightness. It has therefore been thought probable that a good lake might be made from it, although not yet employed by the manufacturer.

CARMINE is said to be the discovery of a Florentine monk, who being engaged in the preparation of some medicine in which cochineal was used, observed a bright red precipitate. For the sale of this as a colour, his convent

afterwards became famous. The manufacture of carmine was long kept secret, and even in the present day the best methods of preparing it are unknown, except to those who have been fortunate enough to make the discovery.

Carmine is a colouring principle, found in the body of a small insect called the cochineal. When properly prepared and quite pure, it is of a lustrous purplish red colour. It is said that in the manufacture of the colour, the character of the water is of no small importance. At the national manufactory of tapestries at the Gobelins at Paris, there is a small, narrow and dirty ditch, and the houses on each side are occupied by the dressers of sheepskins. The water of this ditch is used by them in various parts of their art, and thus becomes animalized, if we may so speak. Now it has been found that this water possesses peculiar properties in dyeing the reds at the Gobelins, for the workmen cannot obtain the lustrous appearance of the Turkey reds unless that water be used. We have been informed, by a manufacturer of carmine, that the finest colour is always obtained with tainted water, a statement which confirms the general opinion, that the production of a rich colour greatly depends upon the use of a suitable solvent.

There are many methods of manufacturing carmine, one or two of which may be mentioned.

1. Boil in river or rain water a pound of powdered cochineal, and to this add four or five drachms of the subcarbonate of soda and potass. When this liquor has been boiled for a quarter of an hour, add eight or ten drachms of alum, and when the solution has been effected, take the vessel from the fire. In about half an hour, draw it off into clean saucers, and after it has stood for about a week, the carmine will be found deposited at the bottom. This deposit must then be carefully dried, and is fit for use.

2. Madame Cenette, of Amsterdam, it is said, forms carmine by the aid of the acidulated oxalate of potass, better known as the salt of sorrel. Take six pails of river water, and when boiling add two pounds of the best cochineal in powder. Let the boiling be continued for about two hours, and add three ounces of refined saltpetre, and, a few minutes after, four ounces of the salt of sorrel. Continue the boiling after this for ten minutes, and remove the vessel from the fire. When the liquid has stood for about four hours it may be drawn off into saucers, or any other shallow vessels. In about three weeks the carmine will be deposited, and the liquid being removed, the colour must be dried in the shade, when it will be in a state fit for use.

3. A solution of tin is used in some of the processes for the manufacture

of carmine. There are several modes of employing this metal in the preparation of the colour; but an experiment performed in the presence of M. Mérimée may be preferred, although there is some uncertainty as to the substances that were used. The person who made the experiment adopted every artifice to prevent him from knowing the materials employed, but it will not be difficult, as he states, to supply those details which it was intended to hide from him.

"A pound of ground cochineal was put into a copper vessel well tinned; after boiling for a quarter of an hour, two drachms of a substance resembling cream of tartar (probably the salt of sorrel) were added to it, which caused a strong effervescence: the vessel was then taken off the fire, and the mixture immediately filtered through a silken sieve: after this liquid was drawn off clear another liquid was thrown into it, in which a little carmine had been infused, no doubt to disguise its true colour; this addition immediately changed the colour of the decoction from a dull crimson to a bright blood colour. The mixture was then twigged for some minutes with a little broom of fine osier twigs, and passed through a filter of close linen: the carmine remained on the filter; and I took some for trial which I found very good.

"It appeared to me that the liquor which was thrown on the decoction of cochineal contained nitro-muriate of tin, which instantly changed the crimson of the cochineal to scarlet. I think it also contained alum, and as the union of these two salts produce a whitish tint which would have discovered the solution of tin, a little carmine was added to the mixture to disguise it." This process is curious, from the quickness with which the carmine seems to have been thrown down fit for use.

Carmine is a brilliant colour, but cannot long resist the action of a strong light. It is seldom used in oil painting, except when flowers are introduced. It is sometimes adulterated with vermilion, but this substance may be detected by dissolving the suspected pigment in liquor ammonia. The carmine will be taken up by the ammonia, and the vermilion will appear as a sediment at the bottom.

MADDER LAKE.—The introduction of madder as a colour both in dyeing and painting, may be considered as a highly important step in the progress of the arts, and a more than passing notice of the substance, its qualities and uses, will therefore be expected by the reader. It will not, however, be possible to devote so much attention to the subject in these pages as may

be considered necessary for the full description of the experiments which have been made. The reader will rather be directed to the results than the means by which they have been obtained, and should a more extensive acquaintance with the subject be required, reference may be made to the interesting investigations of M. Mérimée, and to the article *Madder* in Ure's Dictionary of Arts and Manufactures.

Madder is the root of a plant, known to botanists as the *Rubia tinctorum*. In selecting such roots as are best suited for the manufacture of the colour, the small ones are preferred. When gathered, they are dried either in the sun or in stoves, and after several processes, the ligneous fibre, which is the only part used for the extraction of colouring matter, is reduced to powder.

Madder yields a matter of a pure red colour, and of a more lasting character than any other animal or vegetable substance. It has been long known and employed, for Pliny informs us that *purpurissimum* was made by staining a white earth, called *creta argentaria*, with madder.

Count Chaptal found in Pompeii a fine rose-coloured lake, which he had no doubt was extracted from madder, when engaged in analysing some colours found in the ruins of that city. Previous to the introduction of cochineal it was used by painters; and Neri, who wrote in the year 1612, gives a description in a work called "*Dell' Arte Vetraria*," of the mode in which it was manufactured. When carmine came into use, madder probably ceased to be employed for a considerable period. But, in 1754, Margraaf discovered a process of extracting the red colouring matter by alum, and precipitating it with subcarbonate of potass. In the year 1826, the Société Industrielle of Mulhausen offered premiums for the best essays upon madder, to consist of original analytical investigations. Much valuable information at this and at a subsequent period was thus obtained, and the attention of some eminent practical chemists was directed to the subject.

There is some difficulty in obtaining the red colouring matter of madder, for the root contains another substance of a fawn or dun colour, the intermixture of which would destroy its value. The fawn-coloured matter, however, is readily dissolved in slightly alkaline water, which does not at all affect the red. The root also contains a large quantity of gummy and saccharine matter. Some idea may be formed of the quantity of the fawn-coloured dye contained in madder by boiling the root in water containing subcarbonate of soda. A brown-coloured solution of a deep hue, like strong coffee, will be quickly obtained.

The process which should be adopted in the manufacture of madder lake is not as yet determined. Every manufacturer has probably some method of his own, but without attempting to describe the peculiarities of practice, it will be sufficient to explain the mode most commonly adopted. The first process is to remove the fawn-coloured matter by frequent washings with alkaline water. This being done, a warm solution of alum water is poured upon the root, and a bright scarlet hue is quickly obtained, and a rose-coloured lake is precipitated by the addition of an alkali. But, as all the fawn-coloured matter is not removed by previous washings, the colour will be in some degree injured without great care. The alum water is used hot, to extract the dye as quickly as possible: the same effect would be produced if the solution were used cold, but a much greater length of time would be required.

It has been stated in a previous page that the character of the water has a great influence upon the colour of carmine, and the observation may be extended to all the lakes. In the manufacture of madder lake, the softest water is to be preferred.

The madder lakes are not unfrequently adulterated, and this may always be suspected when they have a crimson hue. Cochineal is chiefly used for this purpose. From what has been already stated, the reader will have little difficulty in testing the purity of any of these colours that may be placed in his hands; and as the alkaline carbonates do not touch the madder dye, they will be found suitable tests. Boil the suspected colour in a weak solution of carbonate of soda, and, throwing it upon a filter, well wash it; and if the colour be thus moved, it will be evident that it is not a pure madder lake.

ORANGE.

Orange is that colour produced by the intermixture of yellow and red, and is readily formed by the painter of any hue that may be required. Many of the pigments which are called red are in fact orange, and among these we may mention even that which has been called by way of distinction red lead. It is, however, worthy of remark, that in the process of manufacture, the hue of a pigment may be so changed, that two specimens or varieties, bearing the same name, may be of different colours. The name which is given to a pigment may, in one respect, be considered a matter of small importance, but when it is remembered, that a large class of workmen obtain their notions of colour from the names of the pigments they use, this error will be no longer entertained. It would be injudicious to change the names which are now commonly received,

and the attempt to introduce a new nomenclature would probably fail were it made; but, the advantages to be derived from such a change will be obtained, if the house-painter be convinced that his notions of colour must not be formed on the names which happen to be given by the manufacturer to his pigments. The principal orange colours are massicot and minium, but we may also mention the orange chromate of lead and the orange vermilion.

MASSICOT.—Massicot is a protoxide of lead, and when pure has a dull orange colour, but it varies greatly in hue, from a light yellow to a rich gold colour. Before the introduction of Naples yellow it was much used by painters, but is now seldom employed. It is considered a permanent colour in itself, but cannot be safely introduced with other pigments. The massicot of commerce is generally made by calcining ceruse.

MINIUM, or RED LEAD.—There is some difference of opinion among chemists as to the chemical composition of this substance. It is spoken of by Dr. Henry, Mr. Brand, and other eminent writers, as a deutoxide of lead. Dr. Dalton considers it to be formed of one atom of oxygen and six of protoxide; and Dr. Ure says, "it is a peculiar oxide of lead, consisting of two atoms of the protoxide and one of the peroxide, but, as found in commerce, it always contains a little extra protoxide, or yellow massicot."

Minium is made by calcining massicot in a reverberatory furnace with a slow fire, taking care to rake it over frequently during the process, so as to bring every portion in contact with the atmosphere, for the absorption of oxygen. After it has been calcined it is ground in a paint mill. A kind of minium called mineral orange, is made by calcining ceruse.

Minium is extensively used by the house-painter. It is sometimes adulterated with brick dust, which is best detected by treating the suspected colour with diluted nitric acid—the brick dust will remain undissolved.

ORANGE CHROMATE OF LEAD.—This pigment is not so bright as minium, nor is it a perfectly permanent colour, and must therefore be used cautiously by the artist

ORANGE VERMILION is, as will be supposed from its name, a preparation of mercury. It is a warm and powerful colour, with a good body; works well in oil, and is a good drier.

THE PURPLES.

The purples introduced in decoration are, for the most part, formed by the intermixture of two pigments, a blue and a lake, but a few pigments of a purple colour have been manufactured for the use of the artist, and deserve notice in this place. Purple was so highly esteemed by the ancients, that it was considered a representative of royalty, the regal robes being formed of stuffs coloured with that dye. Hence arose in the time of the Greek emperors the phrase, 'born in the purple.' It has ceased to be the exclusive property of royalty, but is now not less esteemed as a rich and gorgeous colour. The imperial purple of the Romans was extracted from a shell fish, the *Buccinum lapillus*. The cochineal lakes, when treated with an alkali, especially ammonia, produce brilliant but evanescent purples.

PURPLE OF CASSIUS.—The Purple of Cassius is a metallic and vitrifiable colour, and may be prepared by the following process:—Take pure gold and dissolve it by the aid of heat in nitro-muriatic acid. To avoid an excess of acid, which would discolour the precipitate, evaporate the solution gently nearly to dryness. Then take the chloride of gold which remains, and dissolve it in cold water. A solution of tin must be then made, at a low temperature. The following is the best method of forming a solution of tin:—To one part of nitric acid add two parts of muriatic acid; dilute this liquid with a considerable quantity of water, and introduce small pieces of pure tin foil until the action upon the tin ceases, and the solution be saturated. In this operation the greatest caution is necessary to keep the solution cold, so that if the chemical action of the acid should raise the temperature, the vessel containing the solution should be plunged into cold water. Now pour, drop by drop, the chloride of gold into the solution of tin, and a bright purple precipitate will be thrown down, which is the purple of Cassius. When this has been collected and washed, it is fit for use.

This pigment, until lately, has been used only by the enamel painter and glass stainer, but when combined with alumine and calcined in the same manner as cobalt, a rich pigment for the use of the oil painter is formed, and one, it is said, which will bear the action of strong light. From what has been said, it will appear that the purple of Cassius is a combination of the oxides of gold and tin.

TRITOXIDE OF IRON.—In the vitriol manufactories of Nordhausen, in Germany,

the sulphuric acid is prepared from sulphate of iron, better known as the green copperas of commerce. The residue in the retorts after distillation, is a tritoxide of iron, which is a powder of a purplish red colour. When this substance has been washed, dried, and calcined at a white heat, it assumes a permanent, rich purple hue, and forms a useful pigment for the artist and enamel painter. This is the only purple, with the exception of that just mentioned, which can be used in fresco painting.

MADDER PURPLE.—Mr. Field proposes, in his "Chromatography," the use of a madder purple, which he speaks of as being richer, and more durable and transparent, than the purple of Cassius.

THE GREENS.

Artists are accustomed to form the various tints of green by the admixture of yellow and blue, as being more convenient than the use of different pigments, and having the advantage of confining them to a fewer number of colours. The house-painter also finds this practice the most convenient in some instances, but there are others which almost compel him to use a manufactured colour. "The artist," says an eminent teacher, "will find it much better to compound his green tints from the various yellows, browns, and blues, than to encumber his palette with too many colours, especially as they are seldom of the tint that he wants, without an admixture; and in most cases the whole colour is as readily compounded as the admixture." To the artist, however, it cannot be unimportant to know the composition and manufacture of the colours which he may sometimes have occasion to employ, and to the house-painter it is a necessary branch of information. The green pigments most commonly employed are Scheele's green, verdigris, Vienna or Brunswick green, malachite and mountain green, the oxide of chrome, and green earth.

SCHEEL'S GREEN.—The pigment known as Scheele's green derives its name from the celebrated chemist by whom it was discovered. It is an arsenite copper. The following is the process by which it is commonly prepared:—Take two pounds of the carbonate of potass and dissolve it, with eleven ounces of white arsenic, in two gallons of boiling water. Then dissolve two pounds of crystallized sulphate of copper in warm water, and filter both the solutions. Then add the arsenical solution to the solution of copper, in small quantities, keeping it well stirred during the process. A rich green precipitate will be

thrown down, which must be several times well washed with warm water. One pound six ounces of the pigment will be produced from the quantities of its component substances already mentioned. By analysis it is found to consist of oxide of copper 28.51, arsenious acid 71.46.

By adopting this process, there is some difficulty in obtaining precisely the same hue in all cases, on account of the variable quantity of alkali contained in the potass, and a loss in one of the ingredients is scarcely to be avoided. To obtain a more constant colour, the arsenic in powder should be dissolved in warm water and added to the sulphate of copper. The precipitate is then formed by the addition of a solution of potass. To ascertain whether the colour will be such as is required, it may be tested in a wine glass. If too yellow, more of the sulphate of copper must be added to the solution. The usual proportion is one part of arsenic to ten of the sulphate of soda. The precipitate will be of a paler hue when made from cold solutions than from warm.

The colours in which arsenic enters as a component part are considered to be wanting in permanence, but this objection does not apply to Scheele's green.

VERDIGRIS.—Verdigris (*Vert de gris*) is a fine permanent bluish green colour, known to chemists as the subacetate of copper. It is made in large quantities at Montpellier, Grenoble, and other places in the South of France, by spreading the husks of grapes upon plates of copper. By fermentation the acetic acid is combined with the copper, forming upon the surface a green rust, which is verdigris or the subacetate of copper. Dr. Ure has given an interesting and particular account of this domestic manufacture, which it will be desirable to extract for the benefit of those who have not an opportunity of consulting the Dictionary of Arts and Manufactures. "The copper used in this manufacture is formed into round sheets from twenty to twenty-five inches in diameter, by one twenty-fourth of an inch in thickness. Each sheet is then divided into oblong squares, from four to six inches in length by three broad, and weighing about four ounces. They are separately beaten upon an anvil, to smooth their surfaces, to consolidate the metal, and to free it from scales. The refuse of the grapes, after the extraction of their juice, formerly thrown on to the dunghill, is now preserved for the purpose of making verdigris. It is put loosely into earthen vessels, which are usually sixteen inches high, fourteen in diameter at the widest part, and about twelve at the mouth. The vessels are then covered with lids, which are surrounded by straw mats. In this situation the materials soon become heated, and exhale an acid odour; the fermentation beginning at

the bottom of the cask, and gradually rising till it actuate the whole mass. At the end of two or three days the manufacturer removes the fermenting materials into other vessels, in order to check the process, lest putrefaction should ensue. The copper plates, if new, are now prepared by rubbing them over with a linen cloth dipped in a solution of verdigris, and they are laid up along side of one another to dry. If the plates are not subjected to this kind of preparation, they will become black, instead of green, by the first operation. When the plates are ready, and the materials in a fermenting state, one of them is put into the earthen vessel for four and twenty hours, in order to ascertain whether it be a proper period to proceed to the remaining part of the process. If, at the end of this period, the plate be covered with an uniform green layer, concealing the whole copper, every thing is right; but if, on the contrary, liquid drops hang on the surface of the metal, the workmen say the plates are sweating, and conclude that the heat of the fermented mass has been inadequate; on which account another day is allowed to pass before making a similar trial. When the materials are finally found to be ready, the strata are formed in the following manner:—The plates are laid on a horizontal wooden grating, fixed in the middle of a vat, on whose bottom a pan full of burning charcoal is placed, which heats them to such a degree, that the women who manage this work are obliged to lay hold of them frequently with a cloth to lift them out. They are in this state put into earthen vessels, in alternate strata with the fermented materials, the uppermost and undermost layers being composed of the expressed grapes. The vessels are covered with their straw mats, and left at rest. From thirty to forty pounds of copper are put into one vessel." At the end of a period, varying from ten to twenty days, the vessels are opened, to ascertain whether the operation be complete, which is known by the whiteness of the materials if that be the case. If detached glossy crystals be perceived on the surface of the plates, "the grapes are thrown away, and the plates are placed upright in a corner of the verdigris cellar, one against the other, upon pieces of wood laid on the ground. At the end of two or three days they are moistened, by dipping in a vessel of water, after which they are replaced in their former situation, where they remain seven or eight days, and are then subjected to momentary immersion, as before. This alternate moistening and exposure to air is performed six or eight times, at regular intervals of about a week. As these plates are sometimes dipped into damaged wine, the workmen term these immersions, one wine, two wine, &c. By this treatment the plates swell, become green, and covered with a stratum of verdigris, which is readily

scraped off with a knife. At each operation every vessel yields from five to six pounds of verdigris, in a fresh or humid state; which is sold to wholesale dealers, who dry it for exportation. For this purpose they knead the paste in wooden troughs, and then transfer it to leathern bags, a foot and a half long, and ten inches in diameter. These bags are exposed to the sun and air till the verdigris has attained a sufficient degree of hardness. It loses about half its weight in this operation; and it is said to be knife-proof, when this instrument, plunged through the leathern bag, cannot penetrate the loaf of verdigris."

The distilled verdigris of commerce is a super-acetate of copper. One part of verdigris is dissolved in two parts of acetic acid. The solution is then allowed to stand, and the clear liquor being poured off, vinegar is added to the residuum, and another saturated solution being formed, is added to that previously obtained, and the whole is slowly evaporated. The crystallization is then effected upon a suitable mould. The crystals are of a rhomboidal form and of a beautiful green colour, and quite transparent. A purer colour is prepared from this substance than from the common verdigris, and one which has been extensively used in the arts.

SCHWEINFURTH, VIENNA, OR BRUNSWICK GREEN.—This colour was discovered in the year 1814, by MM. Rusz and Sattler of Schweinfurth, and from that place derives its name. For some time the composition of this pigment was kept secret; but in the year 1822, Professor Liebig, a chemist well known for his admirable works on the analysis of organic bodies and many original discoveries, made known the process of manufacture, and about the same time Braconnot published another method of producing the same substance.

The following is the process recommended by Liebig:—Take equal quantities of verdigris and white oxide of arsenic. Boil in a copper vessel some distilled vinegar, and in it dissolve the verdigris, and form a watery solution of the oxide of arsenic. When these two solutions are mixed, an olive green precipitate is thrown down, and acetic acid is disengaged. This precipitate is then collected and re-dissolved in distilled vinegar, and when boiled, a new granular precipitate of a bright green colour is formed. The liquid being drawn off, the colour is carefully washed. The boiling need not be continued for a period of more than a few minutes. "As fine a colour is produced by ebullition during five or six minutes, as is obtained at the end of several hours, by mixing the two

boiling solutions, and allowing the whole to cool together. In the latter case the precipitate, which is slight and flocky at first, becomes denser by degrees; it next betrays green spots, which progressively increase, till the mass grows altogether of a crystalline constitution, and of a still more beautiful tint than if formed by ebullition."

The following process is that recommended by M. Braconnot:—Dissolve six parts of the sulphate of copper in warm water; and to this add by degrees and slowly, a solution of six parts of the white oxide of arsenic, and one part of potass. A greenish yellow precipitate will be observed when the effervescence has subsided. Then add three parts of acetous acid, and in a few hours, the precipitate being acted upon by the acid, a new deposit of a fine green colour will be produced. The liquid is then poured off, and the colour is carefully washed and dried.

According to the experiments of M. Ehrmann, Schweinfurth green consists of oxide of copper 31.666; arsenious acid 58.699; and acetic acid 10.294. It is a brighter and far more beautiful colour than Scheele's green, but is, like it, a rank poison, and must therefore be used with peculiar care to prevent accidents.

MALACHITE, OR MOUNTAIN GREEN.—This substance is a native carbonate of copper. The term malachite has been applied to those solid masses which are produced from water containing carbonic acid and a solution of the oxide of copper. The mountain green is the same substance, found in the state of powder. Both these have probably been used in the arts for many ages. Malachite was used by the ancients for the manufacture of costly ornaments, many of which are now preserved in our museums of curiosities. By analysis it is found to consist of carbonic acid 18.5; deutoxide of copper 72.2; water 9.3. It is a rich and bright green.

The carbonate of copper may be produced artificially, but has not so bright a colour as the malachite. It is made by adding the sub-carbonate of potass to a solution of copper.

THE OXIDE OF CHROME.—This substance is found as a natural production, but in quantities too small to supply the demand for it in the arts. It is chiefly employed in dyeing and porcelain painting, and nearly all that is brought into the market is produced by artificial means.

The oxide of chrome is prepared by the decomposition of chromate of mercury,

through the agency of heat. The chromate of mercury has at common temperatures a fine red colour, but when raised to a dull red heat parts with a portion of its oxygen and its mercurial oxide. For the formation of the oxide of chrome, it is exposed to the heat of a reverberatory furnace in a retort, and when raised to a sufficient temperature decomposition is effected, the oxygen being disengaged in its gaseous state, and the mercury vaporized, though afterwards condensed by a suitable arrangement: the oxide of chrome remains in the receiver. According to M. Dulong, the purest chromate of mercury is not the best suited for the production of an oxide of chrome, with a green colour adapted for painting, for a finer green is obtained when a little oxide of manganese and chromate of potass are present.

M. Delasaigne has discovered another mode of producing the oxide of chrome, which is more economical and more easily performed than that already mentioned. It consists in calcining in a closed crucible equal parts of sulphur and chromate of potass. A greenish substance is thus produced, which is well washed with a lye to dissolve the sulphate of potass formed during the process. The oxide of chrome is precipitated, and after several washings may be obtained quite pure.

TERRA VERTE, or GREEN EARTH.—There are several natural earths of a green colour, which have been employed by artists. The most common of these is that found on Monte Baldo, in the vicinity of Verona. Klaproth analyzed this mineral, and found it to consist of silex 53; oxide of iron 28; magnesia 2; potass 10; water 6. A similar substance is also found in other places, but that from Verona is most esteemed by artists, who speak of it as an excellent colour. It was much used by the old masters, and in some of their paintings has evidently darkened by age.

BROWN.

The colours which are classed under the general term browns are an important series to the artist, but are little employed by the house-painter. They are derived from mineral, vegetable, and animal substances, and an acquaintance with their composition and manufacture will be both interesting and important. Our notice of them must, however, be brief, although it will probably be found sufficient for the purposes of the reader, as it will give a general knowledge, and be, at the same time, sufficiently minute to enable those who study by experiment, to form the colours for their own instruction and amusement.

RAW UMBER.—This substance is brought from Cyprus, where it occurs in beds with brown jasper. It is a massive mineral, of an olive brown colour, which becomes darker when calcined. It consists chiefly of the oxide of manganese, the oxide of iron, silice, and alumina. It is a useful colour, both in oils and in water, but is, in the present day, most used in the latter vehicle. An objection has been made to its use, because it becomes darker by age. A knowledge of this fact is important, but it must not be considered a reason for its entire rejection.

CASSEL AND COLOGNE EARTHS.—These substances are supposed, by mineralogists, to be lignites, or earthy matter, resulting from the decomposition of vegetables. However this may be they are bituminous, or, in other words, contain a large quantity of bitumen. Mr. Fielding, speaking of Cologne earth, says, "it has something of the taste of oak-bark, and appears to be the produce of wood that has lain long in the earth. It is found in England in the Mendip-hills, and other places, but the German is to be preferred. This colour has most of the properties of Vandyke brown. The snuff-makers on the continent use more of this substance for colouring and adulterating their snuffs than is consumed by artists, although as a colour it has always been in estimation." These earths become lighter when long exposed to the air, which is a great objection to their use, but this may be prevented by mixing them with those colours which are permanent. M. Mérimée mentions a circumstance which shows the importance of following this recommendation. I remember to have seen, he says, a head, the brown hair of which had been painted with a mixture of this colour, and white for the light, but this was darker than the parts painted with the earth unmixed, for the white had fixed the colour.

VANDYKE BROWN.—This substance is a bituminous earth, generally found in the vicinity of bogs, and other places where vegetable matter is in a state of rapid decay. As a colour, it is highly esteemed by artists, but it can be used only with the strongest drying oils.

ASPHALTUM.—Asphaltum, or bitumen, is a substance found on the surface of the Dead Sea, and collected in various states of combination in all parts of that desolate and melancholy district in which the lake Asphaltites is situated. The common method of preparing bitumen is to dissolve it in turpentine, and

then mix with it a sufficient quantity of mastic varnish, to reduce it to a proper consistence.

"It may also be prepared," says M. Mérimée, "in the following manner:— Venice turpentine 15 grains; gum lac 60; Asphaltum 90; drying oil 240; white wax 30. The gum lac is first dissolved in the turpentine, by adding fifteen grains at a time, and allowing it to melt before the other portion is added; the asphaltum is then to be mixed in like manner, by degrees; the linseed oil, having been heated near to the boiling point, is also by degrees mingled with the rest; the wax is then added. Before the mixture cools, it should be thrown on the stone, and well worked with the muller and knife. Thus prepared, the bitumen will dry in one day, equal to flake white; but as a skin will form on the surface of the mass, this must be prevented by placing it into a tin cylindrical vessel, covered with a disc of the exact diameter of the interior. By pressing this disc, in which is a small hole, the bitumen oozes out, and then the hole is closed with a wooden peg, so as to prevent the air from coming in contact with the surface of the liquid. In this way it may be preserved soft for a long time. A greater degree of solidity would be given to the bitumen if it were dissolved in amber varnish: sixty grains of this varnish should be substituted for turpentine. The gum lac will dissolve readily in the varnish."

Asphaltum is a beautiful brown colour, but is liable to crack, and especially when freely used in glazing. This, however, may be probably much prevented, by the adoption of some improved mode of preparation.

BROWN FROM PRUSSIAN BLUE.—By exposing Prussian blue to a sudden and strong heat for a short period of time, it will, when crushed, be found to have partly a black and partly a yellow-brown colour. From the experiments of M. Bouvier, who first published this process, the change of colour cannot be effected in that sort which is manufactured in England, from which M. Mérimée deduces that a blue containing much alumine must be employed, a substance of which that manufactured in England has but little. We have, however, met with specimens of English Prussian blue, in which this change of colour has been readily effected. The colour thus formed is very transparent, a quick drier, and permanent.

MUMMY.—The substance called mummy is obtained from the tombs of Egypt,

and is the produce of the decomposition of embalmed bodies. It contains bitumen, but does not crack like that substance, and is, in every respect, a better colour.

BROWN PINK.—This colour, which is made from French berries (*rhamnus infectorius*), is but little esteemed by artists, for it is a bad drier, and wants permanence. The mode of manufacture is by precipitation with alum; but it has been suggested, with great propriety, that the colour would be much improved by precipitation with the acetate or sulphate of copper.

BLACK.

All the blacks used in painting are varieties of carbon, and differ chiefly from each other in the substances from which they are produced. The most important are bone-black, ivory-black, blue-black, coffee and lamp-black, and Indian ink.

BONE-BLACK is produced by calcining bones in a close vessel, and afterwards grinding to powder on a slab. **IVORY-BLACK** is made in the same manner, from the dust and parings of the substance from which it is named. Both these colours are permanent, but are remarkably bad driers. The bone-black has a somewhat warmer tone than that produced from ivory, which is most esteemed by painters, although commonly much adulterated with the former.

BLUE-BLACK is a charcoal, made by calcining, in a closed vessel, the shells of stone fruit, such as apricots, peaches, and nuts, to which may be added the cuttings of vines, and other new woods. **SPANISH BLACK** is made from cork; **COFFEE-BLACK** from the husks of coffee.

LAMP-BLACK is a term applied to all those blacks produced by burning oleaginous or resinous substances, such as oil, tallow, turpentine, and tar. The manufacture consists in collecting the carbon thrown off during combustion. Lamp-black is a bad drier, and is also objected to by some artists upon other grounds, but it will be sufficient to state, that it is produced by various means, and consequently the several varieties differ considerably in quality.

CHAPTER VIII.

MANUFACTURE OF OILS AND VARNISHES.

HAVING explained, as fully as seemed necessary, for the purpose of our work, the composition, manufacture, and qualities of pigments, we must now proceed to notice the vehicles by which they are to be applied to prepared surfaces, and the varnishes by which they are to be protected from the action of light and of atmospherical changes. Colours must be employed in a moist and liquid state, and the fluids chiefly used for this purpose are the fixed oils, turpentine, and water, which are then called vehicles by painters. These substances are used in various combinations and in different proportions, according to the fancy of the artist, some persons choosing one vehicle and some another. The object, however, is the same in all cases, to give a body or consistence to the pigment, so that it may form a full and enduring film upon the surface to which it is applied. Water and spirituous substances are not in their simple state adapted for this purpose, for they evaporate entirely when exposed to the atmosphere for a sufficiently long period, and leave the pigment as a dry dis-united film, there being no medium to connect and bind together the particles of which it consists. The painter, therefore, when he mixes his colours in such fluids, adds a glutinous substance, such as beer, milk, size, or varnish, so as to give it the necessary consistence. The oils are the best, and may perhaps be called perfect vehicles, but they are not well suited for this purpose. The linseed, nut, and poppy, are preferred, and even these have a property which is disadvantageous to the painter, that of retaining their moisture for a long time, which defect is remedied by artificial means.

Certain oils also enter largely into the composition of varnishes; in fact, the house-painter and artist are as much dependent, for the durability of their works, on the purity and quality of the vehicles and varnishes they use as upon the pigments themselves. It will, therefore, be desirable that the reader should be informed of the chemical constitution of the oils generally, and the qualities,

in particular, of those employed in painting, before any attempt be made to describe their use as vehicles or varnishes.

THE OILS.

Oils have been divided into two classes, the fixed, and the essential, or volatile. The oils of the latter class are sometimes called the distilled, but this term is not absolutely correct, for they are frequently obtained by mere mechanical pressure. It may, however, be observed that the essential oils are generally procured by distillation at the temperature of boiling water, but not the fixed or fat oils.

THE FIXED OILS are abundant in both animal and vegetable structures, and are similar in composition to other fatty substances, being chiefly formed of carbon, hydrogen, and oxygen. These oils are sometimes found in seeds, sometimes in the kernels of fruits, and occasionally in the root or bark of plants.

The fixed oils when exposed to the action of the atmosphere gradually thicken, and some of them become quite hard. Those which undergo this change without leaving a stain on paper when applied to it, are called drying oils, and of these the most important are the linseed, nut, and poppy oil, which are extensively used in painting, and will be particularly described in a subsequent page. Those of the fixed oils which do not thus harden are unctuous, and are so called.

The fixed oils are preferred to all other substances as vehicles for colour, for they spread evenly and easily under the brush, and leave when dry a glutinous matter, which binds the particles together. The colour is thus made more tenacious than when water or any other fluid is used, and less liable to be injured by atmospheric causes. Of these there are some, which, as already remarked, dry more readily than others, and are consequently especially valuable to the painter. The want of this quality may be in some degree corrected by artificial means, but it is important that the oil itself should possess the property. Oils intended for the use of the painter should also be colourless, or they will give a fictitious hue to the pigments with which they are employed. The cold drawn, or expressed oils, have less colour than those which are extracted by heat, but they do not generally dry so quickly. With the oxides of lead the fixed oils form a paste, which has strong drying qualities; and with potass and soda, they produce soaps.

The chemical constitution of the fixed oils was long unknown, but by expe-

riments made on fatty substances, M. Chenvreuil, and others, discovered that they consist of two distinct substances, severally called oleine and stearine.

We may now proceed to speak more particularly of the fixed oils, used by the painter.

LINSEED OIL.—This is almost the only oil used by the house-painter. It is obtained from the seed of flax, and in greatest purity by cold pressure, but may be procured in larger quantities, and not much inferior in quality, by a steam heat of about 200° F. It has a brownish colour, but this is in a great measure lost by keeping. It has also been found that it dries better when it has been kept for some time, but is generally used with a drier. The colour is derived from the pellicle which covers the grain, and is soluble in oil.

The importance of linseed oil to the painter, chiefly arises from its small amount of colour, and its drying property. The rapidity with which it dries when boiled, and especially when boiled with the oxide of zinc or lead, gives it a value above all other vehicles. When boiled with the oxide of lead or zinc, it is called linseed oil varnish. It has always some colour and greater consistence than the oil itself, and in the course of twenty-four hours is converted into a hard substance, when spread in a thin layer over a plain surface.

Chemists have endeavoured to ascertain the nature of the change in linseed oil when passing into the state of a varnish. It is generally supposed that the oil obtains an additional supply of oxygen, and a portion of the oxide; but Professor Liebig states that, from some experiments he has recently made on the subject, "the transformation of linseed oil into varnish is based on the elimination of substances which oppose oxidation." According to his opinion, some foreign substance is present, and prevents the contact of oxygen. I shall not decide, he says, whether this substance should be called mucilage; it results, at all events, from the vegetable albumen of the seed employed for the extraction of the oil.

"The following investigation," says the same author, "will, perhaps, be sufficient to justify the opinion which attributes the transformation of linseed oil into varnish, to a purification of the oil, the sole condition of its solidifying in the air. If mere boiling augments, as we know it does, this property, it is still farther increased when we add to the boiling oil oxide of lead, acetate of lead, or oxide of zinc. Boiling at a high temperature gradually destroys the mucilage; there occurs a solution of the oxide of lead, and the formation of a compound, which remains dissolved in the excess of oil."

M. Liebig states, that he has proved, by experiment, the linseed oil varnish to be prepared in the best and simplest manner by the use of the subacetate of lead. This substance is carefully mixed with linseed oil, by stirring, at the ordinary temperature. After the mixture has stood for some time, a white slimy deposit, containing the oxide of lead, will be thrown down, and the supernatant oil will be converted into an excellent varnish. "The following proportions are well adapted for its preparation in the large way:—There are poured into a suitable vessel, on 500 grammes of subacetate of lead, 2500 grammes of rain-water, and when the solution is completed, 500 grammes of finely levigated litharge are added: the solution of the litharge may be accelerated by exposure to a moderate heat, and by frequent stirring. When no more bractæ of litharge can be seen, it may be considered as finished. There is formed in this operation a brilliant white deposit, which may be either left in the liquor, or separated from it by filtration. Solution may be effected in a quarter of an hour, by boiling; but, if no heat be employed, the mixture must be left to itself for several days. The solution obtained, serves for the preparation of 10 kilogrammes of varnish: it is diluted with its own volume of water; and 10 kilogrammes of linseed oil, into which five hundred grammes of levigated litharge have been distributed, are added by degrees, stirring frequently. By renewing, three or four times, the contact of the lead solution with the oil, by repeated stirrings, and then leaving the mixture to clarify in a warm place, the yellowish and clear varnish is obtained floating on the aqueous liquid, in which is found the white deposit, and of which there has been a question. The filtered aqueous solution contains all the acetate of lead first employed: it may be used for all subsequent preparations, instead of a fresh solution of acetate of lead, after five hundred grammes of litharge have again been dissolved in it."

We may here observe that Mr. Charles Watt has proposed, in an excellent periodical work called "The Chemist," from which the account of M. Liebig's experiments has been obtained, the use of a dilute solution of chromic acid to extract the colour from linseed and other vegetable oils. "As, however," he says, "in these oils the oxide of chrome combines with the glutinous matter they contain, I have found it better to add to the solution a little muriatic acid, which entirely prevents that effect; but I do not approve of more than just enough for the purpose, and I prefer adding it at the end of the operation, as it then combines with the oxide of chrome, without injuring the oil. The oil is then to be washed with water, to free it from any acid; and, it may here be observed, that in the bleaching as well as washing, a temperature of 120° F.

may be beneficial. The oil is then to be filtered, or to be kept warm long enough to settle, which will require about twelve hours." To those who are interested in chemical inquiries concerning the oils generally, the original article is well worthy of attention.

. NUT OIL.—The oil obtained from the nut of the hazel or the walnut is transparent, limpid, and almost colourless. It is much used by artists, and can be employed as a medium for the most delicate colours.

OLIVETTE, or OIL OF POPPIES.—This is a colourless oil, but less drying in its quality than either of the preceding, for which reason it is not so frequently used by artists as it would otherwise be, for in every other respect it is preferable to nut oil. The poppy is extensively cultivated in Flanders, and the oil was much used in the Flemish school.

DRYING OILS.—In our account of linseed oil and its uses, we have described one process by which its drying properties may be greatly augmented. But many other methods have been proposed and are used, some of which it will be desirable to mention. Several of the oxides and metallic salts have the property of rendering the fixed oils more drying. Among the substances most commonly employed, we may mention litharge, white vitriol, and sugar of lead, to which may also be added several resins as forming varnishes, such as mastic, lac, and copal. In all drying oils, however, litharge is the principal ingredient. The following process is considered to be preferable to any other:—

Take any weight of oil and add one eighth part of litharge reduced to powder, so as to insure a perfect solution. Place this mixture in an earthen vessel over a slow fire, and stir it frequently, taking care to watch it that it may not, by a too rapid ebullition, flow over the vessel. After a short period, scum will begin to rise in large quantities, and as long as this remains the heat must be continued. When the scum disappears, the oil has been brought to a proper state, and a pellicle will be formed on the surface, which, when the vessel has been removed from the fire, will be thrown down, and with it the uncombined litharge. The oil is then poured off into suitable vessels, and has a brownish hue, but this is in a great measure lost when it has stood for a few days.

Another method of combining the litharge with the oil is by long-continued trituration. A yellowish substance of much consistence is thus produced. It

will clear itself if allowed to stand for a few days, or it may be strained through blotting paper. The colour which remains will be thrown off by exposure to light.

It is said that a good drying oil, suitable for many light colours, may be formed, by adding small pieces of lead, or lead filings to linseed and the other oils. They should be thus kept for a few days, and occasionally shaken together, that the oil may act better upon the metal. This liquid is colourless, and dries well.

It is not necessary to mention all the various processes employed by painters and others in the preparation of drying oils, and as the best modes of making them have been spoken of, it is scarcely requisite that any others should be mentioned. But, there is no better mode of correcting the evils which result from an injudicious practice, than by placing the erroneous modes in contrast with more simple and scientific principles. So numerous are the substances, and so strange the mixtures recommended in books, that it is surprising any practical men can place confidence in them; for they generally know, from experience, that the methods which are the most simple are the most effective. The few following processes will give the reader some idea of the uncertain state in which the art of making drying oils is at the present time.

I. To four pounds of linseed oil add one and a half ounces of white vitriol, and six ounces of litharge reduced to fine powders. Place these over a slow fire till the scum ceases to rise. Let the liquid stand for four or five hours to cool, and afterwards pour it off, leaving the fatty sediment at the bottom. In a few weeks it will be clear enough for use.

II. To eight pints of oil add twelve ounces of litharge, and one ounce of each of the following substances, white lead, acetate of lead, and white vitriol, calcined and reduced to powder. To these a head of garlic, sliced, is to be added. Keep the liquid in a state of gentle ebullition till no scum rises, when the liquid will have a reddish and the garlic a brown colour. When taken from the fire and allowed to cool, the pellicle formed on the surface will be precipitated, and when the oil has been kept for a time, it will be clearer and much improved in quality.

III. Another recipe is—one and a half ounce of litharge, and half an ounce of white vitriol to one pint of linseed oil.

IV. For common work, some painters use the proportion of one and a half pound of red lead to one gallon of linseed oil, and this is probably one of the most judicious processes in general use.

In the preparation of drying oils, whatever materials may be adopted, caution will be required. The degree of heat and its uniform application must be studied, or colour will be given to the preparation. It has been recommended that the drying materials should be tied in a bag, and suspended in the oil by a thread attached to a stick supported on the edge of the vessel, but a careful application of heat will render this doubtful expedient unnecessary. The fixed oils do not boil at a temperature less than 600° F., but before they are brought into this state they give off a very inflammable vapour, which circumstance should make those who attempt to manufacture drying oils very careful in their manipulations. It should always be done in a situation where no danger could result from the inflammation of the oil. Should this happen, the experimenter must not throw water upon the fluid, under the hope of extinguishing the flame, for an explosion would certainly ensue;—the safest plan is to put over the vessel some cover, which will prevent the access of the air, without which the combustion cannot continue. The garlic is used to show when a sufficient degree of heat has been communicated, for which purpose a feather may be employed, as it will then appear burnt and shrivelled, in the same manner as when held in a flame.

THE ESSENTIAL OILS.—The essential or volatile oils are obtained from animal or vegetable matter, chiefly from the latter, and by the process of distillation. The properties of these oils are exceedingly different from those of the class already described. They are caustic and odorous, and have little consistence. Some of them possess strong medical qualities. They are contained in various parts and in different organs of vegetables. Some plants have the essential oil peculiar to them distributed throughout their entire structure, in others it is confined to the bark, the leaves, the flower, the epidermis of the fruit, or some particular vessels. The essential oils are usually extracted by distillation. To facilitate this process, water is introduced into the still with the plant whose essential oil is required, and at the boiling point the oil is generally volatilized, the watery vapour being present. The aqueous vapour and the vapour of the oil are condensed in the refrigerator, and the two substances are separated.

The essential oils are rarely to be met with quite pure, being much adulterated before they are brought into the market, and as they are all more or less soluble in alcohol, this substance is extensively used in the adulteration. To ascertain whether any specimen of oil contains the spirits of wine, pour a small quantity of the suspected liquid into a glass vessel, containing water, and if the oil has been thus adulterated, a milky emulsion will be formed, and the oil thus separated

will float on the top of the liquid, so that the quantity of pure oil, and consequently of spirit, may be measured.

The essential oils have the property of dissolving the fat oils; and they are sometimes used in adulteration. If any expressed oil be present it may be detected, by adding to the preparation about three times its volume of spirits of wine, which will take up the essential oil, leaving the other free from its former combination. This fraud may be detected in another manner. A pure essential oil leaves no stain on white paper when allowed to evaporate on that substance, but should a fat oil be present a stain would be produced.

Essential oils of different qualities are sometimes mixed, the cheap with those of greater value. This kind of adulteration is less easily detected than those already mentioned, but it may generally be done by the smell. Turpentine is most commonly used for this purpose, but if a cloth, moistened with the suspected liquid, be exposed for a short time to the air, or to the heat of a fire, the peculiar smell which belongs to the oil will be lost, and the strong effluvia of the turpentine will be detected. If the two essential oils united together, so differ from each other in specific gravity, that one is lighter and one heavier than water, they may be separated by mechanical means, for if they be well shaken for a time, they will range themselves in the order of their specific gravities, that is to say the water will be found between the two oils.

There are only four essential oils employed by the painter, the oils of turpentine, spike, rosemary, and petroleum: of these a short description must be given.

OIL OF TURPENTINE.—This substance, sometimes called the essence or spirits of turpentine, is distilled from the rough turpentine of commerce, which exudes from trees of the fir family. It is a colourless fluid, or should it have a slight amber hue it may be removed by mixing with it a little powdered quick-lime. The colouring matter is combined with the lime when the vessel is well shaken, so as to mix the lime thoroughly with the fluid, and both are precipitated, leaving the turpentine perfectly without colour. It is also a strong, penetrating fluid, and possesses a peculiar odour, which is, to most persons, exceedingly unpleasant. Nearly all the volatile oils combine with spirits of wine as already stated, but turpentine is a very sparing soluble in alcohol. It may be made to dissolve in this spirit by heat, but as the spirit cools the liquids are in part separated.

Turpentine is used extensively in various manufactures, but chiefly as a vehicle

for paint, and in the preparation of varnishes. That which is sold in the shops is commonly adulterated with a fixed oil, but it is easy to detect whether this has been done or not, for if a piece of paper be moistened with that which is impure, it will be found to have a stain when dry, but will be perfectly free from any oily mark if there has been no adulteration.

There are several varieties of turpentine in the market, and of these it will be desirable to give a short account.

1. The *common turpentine* is a yellowish white substance, of the consistence of honey. It is extracted from the *Pinus abies*, and *Pinus silvestris*. It consists of rosin, with 5 to 25 per cent. of turpentine. The manufacturers state that it is simply the turpentine obtained from the pine and purified, but there can be little doubt that it is much adulterated with a fixed oil.

2. The *Venice turpentine* is extracted from the *Pinus larix*, and is brought from Hungary and Switzerland. It is said to contain from 18 to 25 per cent. of oil. Much of that which is sold in the English market as Venice turpentine is made by mixing equal weights of black resin and turpentine together.

3. The *French turpentine* is obtained from the *Pinus maritima*, and contains about 12 per cent. of oil.

4. *Strasbourg turpentine* is extracted from the *Pinus picea*, and yields 33.5 per cent. of oil.

5. The *turpentine of Canada*, or *Canada balsam*, is extracted from the *Pinus Canadensis* and *balsamea*.

A small quantity of succinic acid is found, we believe, in all varieties of turpentine, and hence it is that the oil reddens litmus paper. When the oil has been repeatedly rectified it is found to consist of 84.60 carbon, 11.735 hydrogen, and 3.67 oxygen.

OIL OF SPIKE.—This oil is obtained from the flower of a large species of lavender, commonly grown in the province of Languedoc, and in many parts of England. It is obtained, like the other essential oils, by distillation. It was once extensively employed by the house-painter, but its use has been superseded by the oil of turpentine. As a vehicle for enamel colours it is much esteemed, and its property of dissolving copal renders it exceedingly useful in the manufacture of varnishes.

OIL OF ROSEMARY.—This oil is obtained from the *Rosmarinus officinalis*, the plant whose name it bears. It has less body than the oil of spike, and has

a stronger action upon copal, so that it is better suited for the manufacture of a certain class of varnishes. It is commonly adulterated with turpentine, but this fraud may be at once detected, by the addition of anhydrous alcohol, which has the property of dissolving the oil of rosemary, and consequently sets free the turpentine.

OIL OF PETROLEUM.—Naphtha, rock-oil, or oil of petroleum, is frequently found in volcanic districts, issuing from beneath the surface of the earth. It is an essential oil, prepared in the great laboratory of terrestrial nature. Springs have been discovered on the shores of the Caspian Sea, and among the rocks of Italy. At Yananghoung, upon the River Erawaddy, in the Birman Empire, there are no less than five hundred and twenty petroleum springs, which issue from a blue clay soaked with oil, and resting upon strata of roofing slates. Each spring yields annually 173 casks of 950 pounds each. There are many other places from which rock-oil is obtained, but that which is brought from Persia is most esteemed. It has the property of combining with strong alcohol, and dissolves most of the resins, fats, and wax. It is often adulterated with turpentine, which may be detected by the addition of strong sulphuric acid, as that substance gives to the liquid a reddish brown colour, and increases its density.

The odour of this, as of nearly all other essential oils, is somewhat disagreeable, but the unpleasant effluvia need not be any longer an objection to its use, for M. de Saussure has discovered a very simple mode of destroying the smell, without changing, in any respect, its other properties. This process consists in adding, in small portions, the sulphuric acid of commerce, and allowing the two substances to remain in contact for several days, frequently shaking the vessel which contains them. A black precipitate is thrown down, and this is found to be a combination of sulphuric acid, and the odorous principle of the oil. A small quantity of free acid will be found in the clear liquid when drawn off, but this may be neutralized by saturating the liquid with a solution of caustic potass, or quick-lime.

This brief sketch of the manufacture and properties of the oils employed by the painter as vehicles, or in the preparation of varnishes, will put the reader in possession of the most important facts concerning these substances, so far as relates to their use in the arts. We might now proceed to describe the manufacture of varnishes, and to notice a few of the vehicles used by artists, but before this can be done, with advantage to the reader, it will be necessary to give some account of the bitumens, resins, and other substances which are

combined with the oils in the formation of varnishes. Without this information a very incomplete knowledge would be obtained of the subject we are attempting to explain.

THE BITUMENS, RESINS, AND OTHER SUBSTANCES EMPLOYED IN THE MANUFACTURE OF VARNISHES.

The substances which enter into the composition of varnishes, in addition to those already mentioned, are not numerous, and may therefore be described with all necessary particularity without exceeding the limits to which we are compelled to confine our subjects in this volume. They may all be comprised under the two general terms bitumen and resin. Both these classes of substances are of an inflammable nature, and have many properties in common; the former, however, are of mineral, and the latter of vegetable origin.

THE BITUMENS.—The term bitumen includes a considerable number of substances, differing greatly in consistence and external qualities, but all of them being highly inflammable. Among those which are fluid, we may mention naphtha, and Barbadoes tar; and among those which are solid, asphaltum, the elastic bitumen, and the mineral tallow. It is of the asphaltum we shall speak in particular, as a substance which enters into the composition of some varnishes.

ASPHALTUM.—This curious mineral substance greatly resembles pitch in its external appearance. It is hard and brittle, has a vitreous fracture, and is soluble in turpentine, and the drying oils. It is a principal ingredient in the manufacture of those dark varnishes called japans. It is found in large quantities upon the Dead Sea, or Lake Asphaltites. According to the experiments made by various chemists it appears that asphaltum, when treated with different solvents, yields three distinct substances. Alcohol, when it is made to act upon it, dissolves a yellow resin equal to 5 per cent. of the weight. The residue, when treated with ether, gives a brown resin, equal to 70 per cent. of the weight of asphaltum. That which remains, is very soluble in turpentine, or in the oil of petroleum. The asphaltum is therefore supposed to consist of three resinous principles, of different natures, but they are all dissolved by turpentine, nut, or linseed-oil. It consists, like organic bodies, of carbon, hydrogen, and oxygen, but men of science are by no means agreed in assigning its origin. Asphaltum is extensively employed in the preparation of hydraulic cements, as well as for the manufacture

of certain varnishes, and it has of late come into use as a material in an artificial paving stone.

THE RESINS are, like the bitumens, either solid, or liquids of great consistence; they are also inflammable, and soluble in alcohol and the oils. Upon examination, each one is found to be a natural mixture of several distinct substances, which may be taken up separately by different solvents; thus, for example, one principle will be found soluble in ether, another in alcohol, and a third in turpentine. Resin is a proximate principle in almost all vegetable substances. Some varieties exude spontaneously from plants, or are discharged by artificial incisions through the bark into the wood of the tree, while others are extracted by the action of heat and alcohol. They are in nature very numerous, but our attention will be entirely confined to those which are employed in the manufacture of varnishes.

AMBER.—This substance is found as a mineral, but has all the properties of a vegetable product, and so strongly resembles the resins in external characters and in chemical composition, that it may be classed with them. It consists, like them, of carbon, hydrogen, and oxygen, and in nearly the same proportions. When brought into a flame it ignites, and burns entirely away. It is generally of a yellowish colour, and has a resino-vitreous texture. It is not of modern formation, but is discovered in true geological strata, and is a relic of the ancient world. It is said to belong to the great marine formation of the tertiary group, and is found in nodules of various sizes in the sands, and other strata of the plastic clay series. All naturalists are agreed in the opinion that it is of vegetable origin, for of this there is abundant evidence. Its very form gives some indication of its production, for the larger pieces have the appearance as though they had been in a liquid and flowing state. But we have a still more conclusive evidence of the fact in the enclosure of insects and other organic structures, which, from the transparency of the substance, are quite distinguishable. From the examination of these insects, by celebrated entomologists, it appears that they chiefly belong to those classes which live in the bark of trees, or frequent the trunks for food, but they more resemble the insects of tropical than of temperate climes. Amber is also found in ligneous deposits, which leads to the probable supposition that it was the resin of those vegetable substances which are now presented to us as masses of lignite. From these considerations, then, it will appear probable, if not absolutely certain, that

amber is of vegetable origin, and may, therefore, with propriety, be classed among the resinous bodies.

Amber is much harder than the other resins. It is fused at a temperature higher than that required to dissolve copal. An excellent varnish is made by dissolving it in drying linseed-oil. The varnish in which it enters as a component part, has, of course, a brownish hue, and can therefore be only used for dark colours.

GUM ANIMÉ.—This substance, which derives its name from the number of insects it contains, exudes from the courbaril tree, a native of Cayenne, and various parts of South America. It is of a pale yellowish brown colour, and resembles copal in its general appearance, but is more brittle. It is not dissolved by alcohol, nor by caoutchoucine, but it is converted into a tremulous jelly, by a mixture of these two substances in equal parts. It is softened by heat, and may be brought into a liquid state: a white vapour is then given off, which if condensed in water will be found to contain succinic acid. It is dissolved in oil at a high temperature, and it is also taken up by turpentine; but the solution will appear muddy until the insoluble matter which gives it colour is thrown down.

COPAL.—Copal is the hardest, and to the varnish manufacturer the most valuable, of all the resins. There are two species in the market: one is obtained from the *Rhus copallinum*, a native of Spanish America, and the other exudes from the *Elæocarpus copalifer*, a native of the East Indies. Another variety, it is said, grows upon the coasts of Guinea. In the copal of commerce is found a portion of resinous substance, which has nearly the same appearance as the copal, but melts at a much lower degree of heat. The varnish makers are said to distinguish this from the other parts of the resin, by its greater whiteness and globular structure.

Copal is readily dissolved in ether, and also in equal quantities of caoutchoucine and alcohol. Before it can be used in the manufacture of varnish it is necessary to remove an opaque crust, which is always found upon it, and is probably produced by the united action of the atmosphere and water. For this purpose the gum is soaked in a strong lye for about two days, and when dried and broken up, the opaque covering is thrown off. Another advantage is gained by this process, for those parts which are softer than the others are thus made to adhere to the things which they touch, and are easily removed. By this separation the

varnish maker is able to melt those parts together which dissolve at about the same temperature.

MASTIC is a gum obtained from a species of lentil tree, called the *Pistacea lentiscus*, which is common in the isles of the Archipelago, and especially abounds in Chios. In the Levant it is chewed by the inhabitants, and the larger portion of that collected in Chios, which is most esteemed, is sent to the Grand Seignior, and is used in the seraglio. It is transparent and odorous, occurs in the form of drops, and softens in the mouth.

With a heat equal to that of boiling water it liquifies. In alcohol it is partially dissolved, and the solution has a cloudy appearance. Mastic consists of two resins, one of which is soluble in weak alcohol, and the other only in the strongest. It is perfectly soluble in the fixed and volatile oils. To the varnish maker it is an invaluable substance.

SANDARACH.—This substance, in its external appearance, greatly resembles mastic. It is transparent, of a yellow colour, and occurs in drops. It is the produce of a small tree of the coniferous family called the *Thuya articulata*, a native of northern Africa, and said to be especially abundant round Mount Atlas. Although it, externally, greatly resembles Mastic, in every other respect it differs from that important resin. It does not soften in the mouth, and dissolves readily in alcohol, but not in the oil of turpentine. At a moderate heat it melts in the fixed oils, but a high temperature is required for a perfect combination. It is said to consist of three distinct resins. Reaumur states that, having steeped it in spirits of wine, he has dissolved it in the oil of spike; but Merimée repeated the experiment without success.

LAC.—There is one other resinous substance used by the varnish maker, which it will be necessary to mention; and it may be placed distinct from all others, as being of animal origin. This substance is sometimes improperly called gum-lac; but is in fact produced by an insect, called the *Coccus ficus*. This insect is found on the *Ficus religiosa*, the *Rhamnus jujuba*, and other plants, natives of Siam, Assam, Bengal, and Malabar. In November or December, we are informed, the insects are produced from the eggs, and soon after fasten themselves to the bark of the shrub by a transparent glutinous liquid, which continues to increase to the end of March. In this the eggs are enveloped, and it is the stick lac of commerce. Lac is a hard, trans-

parent substance, of a red colour, but the colouring matter is easily removed. The Siam lac is preferred to all others. It is extensively employed in the manufacture of sealing-wax, as well as of varnish.

THE VARNISHES.

We may now proceed to an explanation of the manner in which the various kinds of varnish are made; and if the reader has acquainted himself with the facts already stated, in reference to the substances which enter into their composition, he will have no difficulty in following the account we are about to give.

Varnishes are made by dissolving a resinous matter in spirits of wine, oil, or some other fluid. The objects for which they are applied, are to give a hard and transparent covering to the substances over which they are spread, and to protect them from moisture and the action of the atmosphere. When they are applied to painted surfaces they should be devoid of colour, or at least be of such a tint as shall heighten rather than detract from the effect intended to be produced by the artist. As it is very difficult to obtain a colourless varnish, those which have a yellow hue are to be preferred, for although they impart some tint to the painting they cover, they are less injurious than any other. There are, however, some spirit varnishes which are colourless, and they are extensively used by the house-painter and cabinet maker, but are not fit for all purposes in decoration, and are unsuited to the artist. Varnishes should also have the property of spreading evenly and readily under the brush, and of drying quickly. Those authors who have written for the direction of artists, have stated, as a universal maxim, that the varnish employed upon a picture, should have, as nearly as possible, the same character as the vehicle with which it was painted, so that the action of heat, moisture, and the atmosphere, may affect both similarly: if mastic has been employed to any extent as a vehicle, then the painting should be covered with mastic varnish; if copal, then copal varnish should be used. The house-painter having no occasion for any other vehicles than oil and turpentine, seeks for a varnish which will dry quickly, and is in general less careful about its other properties than the artist.

Before we proceed to explain the composition of the varnishes, it will be desirable to give a general view of the mode of manufacture on a large scale, and to mention those cautions which are absolutely necessary in a process attended

with much danger to the property of the manufacturer, and the persons of his workmen.

In selecting a building for the manufacture of varnish, it must be remembered that it should be so far distant from any other building as not to endanger them in the event of fire upon the premises, which is not an uncommon occurrence. To diminish the destructive effect of a fire, when it does happen, the manufactory itself should be constructed of those materials which are least injured by exposure to intense heat, and are not combustible,—in fact it should be made fire-proof. A building about eighteen feet long, and twelve feet wide, will be found sufficiently large, as we are informed by a practical person, for the annual manufacture of four thousand gallons of varnish. In addition to this, warehouses will of course be required for the reception of the materials employed in the manufacture, and of the varnishes when prepared for the market. These should be as far from the manufactory as possible, and especially where large stocks are kept, as a security from fire.

Now, supposing the building to be furnished with the necessary fire-places, the workman may at once proceed in the manufacture of the varnish. Mr. Neile has given in the Transactions of the Society of Arts, vol. 49, an account of the manipulations, which we might extract; but an abstract of his description will be better suited to the character of this book.

Eight gallons of oil being put into the boiling pot, a fire is lighted, and one is also, at the same time, kindled in the gum furnace, and eight pounds of copal are placed in the gum pot, as many bags, each containing eight pounds, as may be required in the intended process, being placed ready for the workman. In about twenty minutes, the gum will be entirely fused, when it will become quite clear, like oil; but this will depend upon the briskness of the fire, and the attention of the workman, for the gum will require frequent stirring. While the gum is on the fire, the assistant brings the oil to a temperature approaching to boiling, and when this has been done, the pot is removed to the ash bed, and three ladles-full of oil are put into the copper pouring jack, which is placed on the iron plate at the back of the gum pot, to be kept hot until required for use. When the gum is nearly fused, the assistant raises the oil jack, and, when directed, pours in the hot oil, after which, the boiling is continued until the substances are thoroughly united. The same quantity of oil is then again placed in the pouring jack, and an equal amount into a spare tin. Three gallons and a half of oil will still remain in the boiling pot, and into this the contents of the gum pot are emptied. When the workman begins to pour, the

assistant should be ready with a piece of old carpet to place over the mouth of the boiling pot, should the varnish be ignited during the mixture, which not unfrequently happens; but if the air be thus excluded, the fire will be soon extinguished. When the gum pot is emptied, half a gallon of turpentine is poured in, and with it the pot is washed out. When wiped out, eight pounds of gum are placed in it, and when fused, the oil is added as in the former instances. After this, there is a third run, as the process is called by the workmen, so that at last there will be eight gallons of oil and twenty-four pounds of gum in the boiling pot. The pot is then placed over a brisk fire, until a scum covers the entire surface of the liquid, and begins to rise, when it is removed to the ash bed, and a small quantity of driers is gradually added. When the scum has gone down, the pot is again placed on the fire, and the remainder of the driers are added. "In general, if the fire be good, all the time a pot requires to boil, from the time of the last gum being poured in, is about three and a half or four hours; but time is no criterion for a beginner to judge by, as it may vary according to weather, the quality of the oil, the quality of the gum, the driers, or the heat of the fire; therefore, about the third hour of boiling, try it on a bit of glass, and keep it boiling until it feels strong and stringy between the fingers. It is then boiled sufficiently to carry it on the ash bed, and to be stirred down until it is cold enough to mix, which will depend much on the weather, varying from half an hour, in dry, frosty weather, to one hour, in a warm summer's day." About fifteen gallons of turpentine are added, and the varnish will then be sufficiently thick, if the materials be good, and the gum be properly fused. But it is well to be assured of this; and it is, therefore, desirable to pour a little into a saucer, when twelve gallons of turpentine have been introduced, and to add more if necessary.

In the manufacture of varnish, much will depend upon the preparation of the oil. Supposing that a good linseed oil has been chosen, it is still necessary that it should be prepared for the use of the varnish maker. A copper pan, holding from sixty to eighty gallons, properly set, over a suitable furnace, is filled to within a few inches of the brim with linseed oil, and a gentle, but increasing heat is applied, which is continued for about two hours. As long as scum rises, it is removed by the attendant, and when this has ceased, the boiling should be continued for about three hours. To separate the mucilage, the best calcined magnesia is added in small quantities, about a quarter of an ounce for every gallon of oil. When this has been done, the oil is boiled for another hour, and the fire is then quenched with water, a cover being previously placed

over the copper to prevent the access of dust. It is then uncovered, and allowed to remain several hours, after which it is drawn off, and stands for two or three months, when it will be perfectly clear. The bottoms are only fit for use in the preparation of black paint.

In melting copal, there is much danger of the ignition of the vapour which rises from it, for, if a single spark from the fire came in contact with it, this would be the result. One of the most experienced of the French manufacturers has contrived an apparatus, from the suggestion of M. Mérimée, by which the possibility of the ignition of the vapour is prevented, and the unpleasant odour is destroyed. The gum is melted in a matrass, and in the neck of this vessel a tin or copper tunnel about two feet in length is inserted. The upper end of this tube is partially closed with iron wire, or probably with wire gauze, and is inflamed on the upper surface, where it burns like common coal gas. A still better plan is to use a curved tube; for the vapour being condensed in it, the volatile oil of copal may be collected, a substance which, when rectified, will be found useful for many purposes. A double object is effected by this process,—the prevention of accidents by fire, and the unpleasant smell of the disengaged vapour.

Copal varnish may be made, in small quantities, in a glass matrass, with a short neck. "This is to be filled," says M. Mérimée, "about two thirds with a mixture containing five parts of nut oil and one part of copal, finely powdered. To prevent any risk in approaching the fire, and to manage the process carefully, the neck of the matrass must be fastened by iron wire to the end of a long forked stick. Thus prepared, the operator holds the matrass over a furnace filled with ignited charcoal, without any flame, and care must be taken not to bring it forward too suddenly. When the oil has acquired a heat superior to boiling water, the copal is seen in agitation, ascending to the surface of the liquid, the temperature rises progressively, the resin ascends in a greater volume, and vapour begins to leave the aperture of the vessel; by degrees this becomes abundant, and fills all the vase, the surface of the oil tumefies like milk when about to boil, and it would evaporate in foam if the vessel were not removed a little from the fire. This is the moment at which the copal begins to dissolve; the oil changing to a state of vapour, has acquired the proper degree of heat to effect that object; and, by giving gently a rotatory motion to the mass, the white vapours and scum soon disappear, and the fire being clearly seen through the liquid, indicates that the operation is complete.

When the copal has not been well ground, some small lumps will appear,

which could not be dissolved because of their size; but this may be done by prolonging the ebullition: the varnish would, of course, become more coloured by remaining longer exposed to the fire. It would, therefore, be better, previous to the operation, to pass the pulverized copal through a silken sieve, or still better, to grind it well with oil before it is put into the matrass: this will certainly quicken the operation, and, consequently, the varnish will be less coloured.

The matrass might be placed in a sand-bath, and allowed to remain there without being stirred until the whitish vapours begin to fill up the cavity, and the oil, mounting in foam, would be in danger of rushing out of the vessel; but in this case, the operation would be much slower, and the fire must be much stronger, to bring the sand up to the degree of heat required. I have tried to produce this combination in a silver vessel, but did not succeed; for the external air prevented the resin from heating, and it was merely softened, though coloured strongly. It is, therefore, better to employ a matrass in which the heat is strong, and kept nearly equal; but to give more certainty to the operation, I would advise that no more than one or two ounces of copal should be dissolved at a time. Should it be necessary to melt several pounds, recourse must be had to the process already described.

Having explained the process of manufacturing varnishes, it will not be necessary to describe all the several varieties which are brought into the market, and employed in the arts, and especially as the account we are giving is more intended to explain the process generally to those interested in the art of house-painting, than to direct the varnish maker in his trade. Every substance may be called a varnish which, when spread over a painted surface, has the property of bringing out the colours; and, by forming a thin transparent coating, protects them from the action of the atmosphere. They may, therefore, be said to be almost innumerable, for a great variety of substances may be employed, and these may be united in extremely different proportions. Varnishes made of resins have been known and used from very ancient times, for when the arts were flourishing in Greece, they were known in India, China, and other oriental countries; and were, no doubt, employed by the Greek artists also; although a different opinion has been formed by some writers, founded upon a passage in the writings of Pliny, where he states that Apelles was indebted for his fame as a painter to the use of a liquid which he calls atramentum. But, whatever opinion may be entertained, concerning the knowledge of this subject possessed by the ancient Greeks, other nations have possessed the art of

varnish making for different purposes, and in modern times the varieties have so increased in number that every manufacturer has formulæ of his own. It will, therefore, appear quite unnecessary that we should encumber these pages with more examples than may be required to give the reader some notion of the substances generally employed, and the proportions in which they are commonly used.

1. THE VARNISHES IN WHICH COPAL IS THE PRINCIPAL INGREDIENT.

COPAL VARNISH FOR PAINTINGS.—A good copal varnish for fine paintings may be made in the following manner:—Take eight pounds of the best pale copal, and having reduced it to a fluid state by heat, add, in small quantities, two gallons of hot drying oil. Boil this mixture till it is stringy. Three gallons of turpentine must then be added, while the mixture is very hot. Then strain it, and should the varnish be too thick, add as much oil as may be necessary, before it is quite cold. Much vapour will rise during the mixing of the turpentine, but this is not to be regarded, as the varnish will be brighter, work more freely, and dry harder.

A HOUSE PAINTER'S VARNISH.—A good house painter's varnish may be formed as follows:—Take eight pounds of the second sorted African copal, and to this add, in the manner already described, two gallons and a half of clarified oil. These are to be boiled till very stringy, when the following substances must be added:—A quarter of a pound of dried copperas, and the same of litharge, with five and a half gallons of turpentine. This varnish, when strained, is to be mixed while hot, with one made of eight pounds of second sorted gum animé; two and a half gallons of clarified oil; a quarter of a pound of sugar of lead and litharge; and five and a half gallons of turpentine.

A PICTURE VARNISH.—A picture varnish is sometimes made from three hundred parts of hard copal, to so much of drying oil as may be thought necessary, varying from one hundred and twenty-five, to two hundred and twenty-five parts, and five hundred of turpentine. The several ingredients are added to each other in the manner already described. The chief danger in the manufacture of these varnishes is, in the addition of the turpentine, the vapour of which is liable to catch fire. As the oil is always more or less coloured when it is raised to near the boiling point, the turpentine is sometimes added to the melted copal, and it is in this way that the whitest varnishes are made. The

one just described is greatly improved by keeping. When good, it will be sufficiently dry in twenty-four hours to bear the impression of the finger.

SHELDRAKE'S COPAL VARNISH.—This varnish is made of two ounces of copal, the same quantity of spirits of ammonia, two drachms of camphor, and one pint of rectified oil of turpentine. It is prepared in a vessel partly stopped, but so that the heated vapour may escape. It is then made to boil gently over a brisk fire, the ebullition being kept up so that the bubbles may be counted as they rise. When the solution of the copal has been completed, the vessel must be allowed to stand unopened until it is quite cold.

COLOURLESS COPAL VARNISH.—The choice of the copal is of the greatest importance in the manufacture of this varnish. To ascertain what pieces are suited for use, it is customary to test them with pure essential oil of rosemary, and to select those which are softened by immersion. Reduce the pieces of gum that may be chosen, to powder, and sift it through a fine sieve. Having placed it in a suitable glass vessel, in quantity not more than half an inch in thickness, add about the same bulk of the oil of rosemary, keeping up a continual agitation until the gum is dissolved. To thin the varnish thus formed, mix with it pure alcohol, a few drops at a time. When it has stood three or four days, it will be quite clear, and may be decanted for use. This varnish takes an excellent polish, and may be used on either wood or metal, and is not unsuited for fancy articles made of pasteboard.

A GOLD-COLOURED COPAL VARNISH.—Take two ounces of essential oil of lavender, and when hot, add, in small quantities, one ounce of powdered copal. Stir the ingredients till the solution is effected, and then add hot, and in small quantities, six ounces of turpentine.

A few general remarks on the manufacture of copal varnish may be now added. It is of importance that the gum should be broken up, for the more perfect the fusion the greater will be the quantity and the strength of the varnish. The boiling should be long continued, and with regularity, for upon this will much depend the ease with which it works under the brush. The gum and oil should be boiled, as already stated, until the mixture is stringy, but this must not be done suddenly, for this will make the varnish less durable, flow less readily, and require a greater proportion of turpentine.

The proportion of oil used in the manufacture of copal varnish must depend on the species of varnish to be made, and the purposes for which it is to be employed. If a quickly drying varnish be required, it is desirable to add about two parts of linseed oil at first, and then, before it cools, two other parts of white drying oil. But, if a varnish of small drying qualities be desired, and one which mixes well with colours, four or five parts of linseed oil to one of resin may be employed. A varnish for pictures, when perfectly dry, may be made of one part of oil to two of copal, brought to its proper consistence by the addition of turpentine. The greater the proportion of oil the tougher will be the varnish, and the less liable it will be to crack. If the gum be introduced in excess, the varnish will be more solid, and it will dry more quickly than when the quantity of oil is greater. The quantity of driers is also to be carefully regarded, for if a substance employed to give the varnish a strong drying quality, be introduced in too great a proportion, it will also produce an unnecessary and injurious opacity, and the varnish will be unfit for use over light colours.

2. THE VARNISHES IN WHICH MASTIC IS THE PRINCIPAL INGREDIENT.

A MASTIC VARNISH.—A fine mastic picture varnish may be made in the following manner:—Put into a four-gallon tin bottle five pounds of sorted mastic. To this add two pounds of glass, broken up to about the size of barley corns, well washed and dried, and two gallons of pure colourless turpentine. Cork the vessel, placing a piece of fine leather over the cork, and roll it backward and forward until all the gum is dissolved, which will require about four hours. The varnish should then be strained through muslin, into another tin bottle, where it should remain exposed to the atmosphere, but protected from dust, for a period of eight or nine months, when it will be ready for use.

FLANDERS VARNISH.—Flanders varnish is chiefly composed of mastic, and may, therefore, be described in this place. Dissolve grain mastic in alcohol, by the application of a slow heat, and a thick, muddy liquid will be produced, but, after it has stood for a short time, the impurities will be precipitated, and a clear liquor be left. Wax must be then added, in the proportion of about one-eighth, and the fusion be made in a water bath. The mixture must then be thrown into cold water, and worked with two wooden spatulas.

The object in this operation is to separate the spirit which unites with the water, leaving the resin and wax in combination, which may then be formed into balls, or rolls, and be kept for any time. When required for use, melt this substance in an equal part of drying oil, at a slow heat, and bring it to the necessary consistence in the usual way.

Another method of manufacturing this substance is, to add to a mastic varnish, formed of equal parts of mastic and turpentine, nut or poppy oil, in the necessary proportions, and one-eighth part of the acetate of lead. Boil this lightly, and pour it into water. It must then be occasionally stirred, and the water be poured off and renewed, until all the uncombined acetate is dissolved.

To accelerate the solution of mastic in oil of turpentine, it is desirable to grind the resin, or break it into small pieces, although it very readily dissolves. If a mastic varnish contain an excess of oil, it is liable to crack. Artists generally prefer it to copal, on account of its being colourless, but the fear of its cracking is an objection to some persons. The advantage in the manufacture of the best copal varnishes is, that the impure parts are not soluble in turpentine, so that a transparent solution is formed.

3. VARNISHES IN WHICH GUM ANIMÉ IS THE PRINCIPAL INGREDIENT.

A WAINSCOT VARNISH.—A good wainscot varnish may be made from two pounds of gum animé and three gallons of clarified oil. These must be boiled till very stringy, and then a quarter of a pound of litharge, a quarter of a pound of dried sugar of lead, and five and a half gallons of turpentine must be added. The mixture must then be strained, and is ready for immediate use.

Mahogany varnish is made with the same substances, and with nearly the same proportions, but a small portion of gold size is often added.

Varnishes made of gum animé do not retain their colour so well as those formed of copal, nor have they the same fluidity and softness. Copal varnish, however, requires a much longer time to dry, and it has therefore become customary to add a portion of gum animé varnish to it, when required for the use of the coachmaker and decorator. In describing the manufacture of a copal varnish for fine paintings, the proportions of the ingredients have been stated.

4. VARNISHES IN WHICH AMBER IS THE PRINCIPAL INGREDIENT.

AMBER VARNISH.—An excellent pale varnish is made from amber, and one which works freely, and is very hard and durable. Take six pounds of picked pale amber, and having fused it, add two gallons of clarified oil. These must be boiled together, till the compound is very stringy. Mix with this four gallons of turpentine. The addition of a little copal varnish is said to increase its hardness and durability.

These are a few of the varnishes manufactured from copal, mastic, and gum animé. The number might be greatly increased, but it is only necessary that the reader should be informed of the composition of those which are in most common use, and these are described as illustrations of the process of manufacture. For the qualities of his varnishes the painter is greatly dependent upon those from whom he purchases, but there are few articles in which the public is less deceived than in these.

5. VARNISHES IN WHICH SANDARACH IS THE PRINCIPAL INGREDIENT.

Sandarach is chiefly used in the manufacture of spirit varnishes; and in our description of these, the reader will find an account of some of those in which it is employed.

6. VARNISHES IN WHICH LAC IS THE PRINCIPAL INGREDIENT.

CABINET LAC VARNISH.—A varnish for cabinet makers may be made of the following substances:—Pale shell lac seven hundred and fifty parts; mastic sixty-four; and alcohol ninety per cent. The solution must be made without heat. The varnish has always a muddy appearance, and is so used by the workman.

In conclusion we may add a few formulæ for the manufacture of some useful varnishes in common use, which the house-painter may be sometimes called upon to employ.

MISCELLANEOUS VARNISHES.

VARNISH FOR MAPS, DRAWINGS, &c.—Take a bottle of Canada balsam, and place it sufficiently near the fire to bring it to a perfectly liquid state. Then

add to it an equal quantity of turpentine, and mix the two substances thoroughly. In this manner a clear crystal varnish is formed, which will be fit for use in a few days, if kept at a gentle warmth.

CAOUTCHOUC VARNISH.—Since the properties of caoutchouc have been made known, it has been brought into extensive use in the arts, and among other purposes, it has been employed in the manufacture of varnish. Caoutchouc varnish is of great value in its application to those substances which are required to have a degree of elasticity. It is produced by adding an equal weight of boiling linseed oil to the gum in a liquid state. This mixture being made, an equal weight of turpentine is added; and when the varnish has been strained, it will be fit for use. It dries slowly; and this is, in many cases, an objection to it; but if caoutchoucine be used instead of caoutchouc, it will dry more quickly.

MILK OF WAX.—This substance is said to be similar to that used by the Romans, for the preservation of their fresco paintings, and was that with which the paintings on the walls of Herculaneum and Pompeii were covered. Take any quantity of white wax, and having melted it in a porcelain vessel, add an equal quantity of spirits of wine. Having mixed these substances thoroughly, pour out the compound upon a large marble slab, and work it with a muller into a paste, adding as much spirits of wine, in small quantities, as may be necessary. Then add water, in the same way, to about four times the weight of the wax, and when strained it will be fit for use. The method of employing this substance is somewhat different from that of other varnishes. It is first spread evenly with a brush, and when dry is fused, on the surface of the colour, by a large hot iron, called a salamander. It is then rubbed with a linen cloth, which brings out the colours with great brilliance and transparency.

BEST BRUNSWICK BLACK.—Take forty-five pounds of asphaltum, and boil it for about six hours. In another vessel boil six gallons of linseed oil for the same period, adding to it, while boiling, about six pounds of litharge. Then pour the oil into the vessel containing the asphaltum, and boil the mixture until it has such a consistence that it may be worked into hard pills. When it is cool, add about twenty-five gallons of turpentine, and it will be soon fit for use.

COMMON BRUNSWICK BLACK.—Take twenty-eight pounds of common black pitch, and the same quantity of asphaltum, and boil them together for eight or ten hours, so as to disengage, as much as possible, the gases they contain, and other substances which would be injurious to the varnish. After boiling all day, this composition may be allowed to stand during the night. In the morning it may be again boiled, and then mixed, in the usual manner, with eight gallons of boiled oil; after which, ten pounds of litharge, and an equal quantity of red lead, should be added. Then boil, till the composition has such a consistence that it may be rolled into hard balls, which will be in about three hours. By the addition of twenty gallons of turpentine the varnish will be ready for the use of the painter. It is chiefly employed for rough iron and engineering work.

IRON WORK BLACK.—A good varnish, for iron work, may be made in the following manner:—Take forty-eight pounds of asphaltum, and having boiled it two hours, add seven pounds of red lead, an equal weight of litharge, three pounds of dried copperas, and ten gallons of boiled oil. Having introduced these, in small quantities, boil two hours more, and add eight pounds of dark gum, and twenty gallons of hot oil. After boiling again for two hours it must stand to cool, and thirty gallons of turpentine may be then added, to bring the varnish to a proper consistence. It is much used by coach builders, and other workmen who employ iron extensively in their manufactures.

We must now proceed to a description of another class of varnishes, those in which spirit is used as a solvent, instead of oil.

SPIRIT VARNISHES.—In the manufacture of spirit varnishes more care is required, if possible, than in the preparation of varnishes of the other class. The danger of fire is always great, and may occur in spite of the care exercised by the maker, so that the buildings in which he exercises his trade should be distinct from all others, and every precaution should be used to prevent accident; but still more caution is required when alcohol is an ingredient in the manufacture.

Spirit varnishes are often made in a common still, the necessary heat being supplied by a steam or water bath. The resinous substances and spirit are usually placed together in the still, in the proper proportions. When the alcohol reaches the boiling point the heat must be lowered, and so regulated as to

prevent vaporisation. To the capital of the still a stuffing box is applied, through which is passed a stirring rod, that has a winch at the top, and a cross piece at the bottom. By constantly turning this the solution is greatly facilitated, and the completion of the process may be known by the ease with which the rod will then move. During this operation, some of the spirit will be necessarily vaporised and condensed, and must be added to that which remains in the still, in combination with the resin, if the proper proportions have been selected to commence with. When the varnish is removed from the still it must be strained through a suitable sieve, and then be allowed to stand until it is quite clear. If the varnish be required for immediate use, it must be strained through some porous paper, which will separate all the small particles that are not held in perfect solution by the spirit.

WHITE SANDARACH VARNISH.—An excellent white varnish may be made from sandarach, with a small proportion of other resins. Take two hundred and fifty parts of sandarach; sixty-four of mastic; thirty-two of elemi resin; sixty-four of Venice turpentine; and eighty-five per cent. of alcohol. When the resins are perfectly dissolved, add sufficient turpentine to bring the varnish into a proper state for working easily with the brush. This is an excellent varnish, but not sufficiently hard to bear polishing.

A HARD WHITE SPIRIT VARNISH may be made in the following manner:—Take five pounds of sandarach, and place it in a four-gallon tin bottle, with two gallons of spirits of wine, sixty over proof. Cork the vessel, and keep its contents in agitation by rolling, or otherwise, until all the resin is dissolved. When the solution is perfect, strain the liquor, and add about two quarts of pale turpentine varnish. Mix them thoroughly, and the varnish will be fit for immediate use. If the varnish is to be kept, the vessel must be well corked, to prevent the access of the atmospheric air.

A SANDARACH SPIRIT VARNISH.—A useful sandarach spirit varnish, suitable for wainscots, and other painter's work, may be made from the following ingredients:—Six ounces of gum sandarach; two ounces of shell lac; four ounces of resin; four ounces of powdered glass; four ounces of clear turpentine; thirty-two ounces of pure alcohol.

SPIRIT VARNISH FOR CABINET MAKERS.—A varnish frequently employed

by cabinet makers is made from pale shell lac and mastic, seven hundred and fifty parts of the former, and sixty-four of the latter, dissolved in ninety per cent. of alcohol. The solution is made without the aid of heat, and by means of frequent stirring.

THE USE OF VARNISHES AS VEHICLES.—Before we close this chapter it may be desirable that we should make a few remarks on the use of varnishes, as vehicles of colour, but this we shall do as briefly as possible, for it is a subject more interesting to the artist than the house-painter. The same vehicle is not used by all artists, as is well known, and even the great masters have employed different substances. Some artists employ turpentine alone, and thus obtain a great purity in the lighter hues and tints, but fail to give a sufficient adhesiveness to their colours. To correct this evil other painters employ equal quantities of turpentine and linseed oil, adding a small portion of bees-wax, which was the custom of Wilson, the celebrated landscape painter. Other artists use boiled oil, with from half to an equal quantity of mastic varnish, which substances are easily mixed, by merely shaking the vessel in which they are contained. This vehicle is called maguile, and has a strong consistence. By many painters it is very highly esteemed.

A substance, called Italian varnish, is also much used by many foreign artists, as a vehicle. It is made from two parts of linseed or nut oil, and one part of finely ground litharge, which must be quite pure: if any portion of the oxide of copper be present, a greenish hue will be given to the compound. About a sixth part of pure white wax may then be added, to give the necessary consistence. To insure the perfect union of all the parts, the substance is ground on a slab with a muller. Before it is used, it must be mixed with mastic varnish, which prevents its frothing under the brush. It flows freely, and gives great transparency to the colours.

English varnish is frequently used by the artist in glazing. It is a compound of mastic varnish, with some drying oil, which holds litharge in solution. It has the consistence of a strong jelly, but may be made more or less firm according to the amount of litharge and the strength of the varnish. M. Mérimée recommends, that a drying oil prepared without fire, should be used instead of the brown drying oil, and that a mastic which has a full body should be chosen; for, he says, if the essential oil be small in proportion to the resin, the drying quality will be less active, and the operations can therefore be carried on in painting much longer, without being interrupted by the vehicle becoming too thick.

Another vehicle is made of equal parts, by weight, of gum mastic and sugar of lead, ground very fine in oil. If it preserved all its original beauty, says Mr. Fielding, it would make one of the most agreeable vehicles with which we are acquainted, but many pictures which we know to have been painted with it have very greatly changed from their original hue, therefore it cannot be recommended when permanence is desired.

In various other forms and proportions varnish is used as a vehicle. These varieties are described by authors who have written for the instruction of young artists, and need not be repeated in these pages.

From this short description of the manufacture and quality of varnishes, the reader will be able to gather some information concerning the propriety of their application under the circumstances in which he may have occasion to employ them. It is impossible, however, to read attentively the various formulæ which are given in this chapter, without perceiving that this branch of manufacture is not built on any broad scientific principle. Had we filled our pages with the almost innumerable recipes which are to be found in the pages of writers on varnishes, this would have been still more evident; but no man can commence the study of this subject, without feeling painfully conscious that the art is, in the full sense of the word, empirical, and that it requires a close scientific investigation.

CHAPTER IX.

MISCELLANEOUS ARTICLES EMPLOYED BY THE HOUSE-PAINTER.

THERE are but few articles in addition to those already described, required by the house-painter in the exercise of his trade, and these might be passed over without remark were we not anxious to excite and satisfy the curiosity of the reader upon every subject connected with this important but long neglected art. In the subsequent chapters we shall have occasion to allude to the use of size, putty, and gold-leaf, in the preparation of work for painting; and it is our intention to make, in this chapter, a few remarks on the manufacture of these substances, that the workman may not be ignorant of any of the materials he is using in his trade. The workman who employs an article the composition of which he does not thoroughly understand, is liable to many errors in its application, and is likely to use it in such a way and under such circumstances that it may altogether fail in the purpose for which it is intended, and may even become positively injurious. Where this cannot be the result, and in cases where the well-informed workman has no practical advantage over his companion, who is ignorant, knowledge gives a superiority which is acknowledged by others and enjoyed by the possessor.

SIZE.—Size is a solution of isinglass, glue, or any other substance which chiefly consists of gelatinous matter. It is employed by the painter for many purposes, which will be explained in subsequent parts of this work.

Gelatine is a substance obtained from the skin, bones, cartilages, muscles, and membranes of animals. Its most remarkable character, or at least that by which it is most evidently detected, is its solubility in hot water, and subsequent conversion into a jelly on cooling. According to analysis, it consists of carbon, in the proportion of 47.88; hydrogen 7.91; oxygen 27.22. When in a state of solution, it may be precipitated by either alcohol, or tannin; the former

produces the effect by withdrawing the water from its combination; the latter, by combining with the gelatine, and forming an insoluble compound, which is in all its properties analogous to leather.

Glue is the substance most commonly employed when gelatinous properties are required. The manufacture of glue is an extremely simple process, for it merely consists in boiling the animal matter from which the gelatine is to be extracted, in warm water. Different qualities of glue are obtained according to the time when the solution is drawn off. Supposing the boiler to be filled with the necessary animal matter, and water as a solvent, heat is applied so as to keep up a constant but low ebullition, and when the solution is sufficiently strong to form a gelatinous mass, it is drawn off, and allowed to stand till it is cool. Fresh water is then added, and another solution is formed, but the glue made from this is not equal in quality to that produced by the previous boiling. In the manufacture of Dutch glue, which was much preferred by workmen to all other kinds, there are always two boilings, and hence there are two qualities, but English glue is all of the same quality, the solution being always made in one boiling. As, however, the whole of the gelatine is not extracted in one operation, hot water is poured upon the residuum, and the liquor obtained from the second boiling, is added to the next solution. In all cases, when the solution has been made of sufficient consistence, it is drawn off into a vessel, where it is allowed to remain for four or five hours to settle, and is then poured into square wooden boxes. In less than four and twenty hours the glue is sufficiently congealed to be turned out of the boxes, and is then cut horizontally by wires, fixed in a wooden frame and guided by rulers, and vertically, where required, by a moist knife. These pieces are then laid upon nets, stretched on wooden frames, and are turned frequently until quite dry. This process of drying is one of some difficulty, and requires considerable care to prevent injury to the material. The light-coloured glue, with a bright fracture, is preferable to all other kinds.

Isinglass has been mentioned as a glutinous substance, and one occasionally employed by the house-painter. It is a semi-transparent matter, of a darkish white colour, and is a nearly pure gelatine. It is prepared from the sound or air bladder of the sturgeon, the cod, and other fish, but that which is made from the former is most highly esteemed. The mode of preparing it by the fishermen, on the shores of the Caspian Sea, where the sturgeon is chiefly obtained, simply consists in steeping the air bladder in water, and then removing the external coat, after which it is twisted into that shape in which it is brought

into the English market. It is dried in the sun, and whitened with the fumes of sulphur.

"In some districts of Moldavia," says Dr. Ure, "another process is followed. The skin, the stomach, the intestines, and the swim bladder of the sturgeon are cut in small pieces, steeped in cold water, and then gently boiled. The jelly thus obtained is spread in thin layers to dry, when it assumes the appearance of parchment. This being softened in a little water, then rolled into cylinders, or extended into plates, constitutes an inferior article. The swim-bladder of the cod and many other fishes, also furnishes a species of isinglass, but it is much more membranous and less soluble than that of the sturgeon."

Isinglass, of which a large quantity is brought into the English market, is an almost pure gelatine. It is used for a great variety of purposes, both in the preparation of articles of food and in many of the arts.

PUTTY.—Putty is an article which the house-painter has very frequent occasion to use, and the manufacture of which he generally understands. It is employed for stopping any small indentations upon the surface of wood, previous to painting. It has the property of hardening with time, and although perhaps not the best substance that could be used, in all cases, it is generally found sufficient for the purposes of the house-painter.

Putty is so simple in its composition, that it is frequently made by the workman who uses it. It consists of finely powdered whitening mixed with linseed oil so as to form a stiff paste, which is well beaten and thoroughly mixed, and is thus made extremely smooth and tenacious. White lead is sometimes added; but it is very doubtful whether any of those qualities which render it useful to the painter, are improved by the union of this substance.

GOLD LEAF.—Metallic leaf is often used by the house painter to cover the knots which appear on the wood he is about to paint. Knots in wood are sometimes killed, to use the term of the workman, by a cement which will be described in a future page, but this mode is not always effective, for stains will often appear notwithstanding the precautionary measures that have been employed. That which exudes from the knot, however, and passes through the cement, would be effectually stopped by a metallic surface, and, for this purpose, gold or silver leaf is employed. There are also other purposes for which metallic leaf is sometimes used by the painter, so that a short description of its manufacture seems to be necessary.

Gold is distinguished among metals for its ductility and malleability, and is, therefore, peculiarly suited for manufacture into thin leaves. Gold may, in fact, be beaten into a leaf not more than the 282,000th part of an inch in thickness, and one grain is made to cover $56\frac{3}{4}$ square inches. This truly wonderful effect is entirely produced by beating; and silver, platinum, or copper, may be reduced to a thin sheet in the same manner. The purest gold is employed in the manufacture of the leaf; for any alloy hardens it, and renders it less malleable. In the production of the leaf there are four processes,—casting, forging, lamination, and beating.

The first process is that of casting. The gold is melted with borax in a crucible, and then cast in iron moulds called ingot moulds, each ingot weighing about two ounces. When the metal is sufficiently hardened, it is turned out of the mould, and placed in hot ashes, which has the effect of softening it: this process is called annealing.

When the ingot is cold, it is beaten with a forging hammer, and reduced to the thickness of about one-sixth of an inch. This process, however, is in some cases omitted. The lamination is effected by powerful cylindrical rollers, which reduces the metal to a thin riband of such a thickness that a square inch will weigh about six and a half grains.

The beating, which is the last process, is the most important, and that which most requires our attention. The gold beater, when he receives the riband of metal, cuts it with shears into small squares about an inch each. "These squares are piled over each other in parcels of one hundred and fifty, with a piece of fine calf skin vellum interposed between each, and about twenty extra vellums at the top and bottom. These vellum leaves are about four inches square, on whose centre lie the gold laminæ of an inch square. This packet is kept together by being thrust into a case of strong parchment open at the ends, so as to form a belt or band, whose open sides are covered in by a second case drawn over the packet at right angles to the first. Thus the packet becomes sufficiently compact to bear beating with a hammer of fifteen or sixteen pounds weight, having a circular face nearly four inches in diameter and somewhat convex, whereby it strikes the centre of the packet most forcibly, and thus squeezes out the plates laterally. The beating is performed on a very strong bench or stool framed to receive a heavy block of marble, about nine inches square on the surface, enclosed upon every side by wood work, except the front, where a leather apron is attached, which the workman lays before him to preserve any fragments of gold that may fall

out of the packet." When the gold is by this beating extended to the full size of the vellum, the sheets are severally cut into four squares. These are again piled up in the manner already described; but skins prepared from ox gut are placed between them instead of vellum. The remaining process is so well described by Dr. Ure, from whose work we have already quoted, that it would be useless to employ other words than those he has furnished. "The second course of beating is performed with a small hammer about ten pounds in weight, and is continued until the leaves are extended to the size of the skins. During this period, the packet must be often folded, to render the gold as loose as possible between the membranes, otherwise the leaves are easily chafed and broken. They are once more spread on a cushion, and subdivided into four square pieces by means of two pieces of cane, cut to very sharp edges, and fixed down transversely on a board. This rectangular cross being applied on each leaf with slight pressure, divides it into four equal portions. These are next made up into a third packet of convenient thickness, and finally hammered out to the area of fine gold leaf, whose average size is from three to three and a half inches square. The leaves will now have obtained an area one hundred and ninety-two times greater than the plates before the hammering began. As these were before an inch square, and seventy-five of them weighed an ounce ($= 6\frac{1}{2} \times 75 = 487\frac{1}{2}$) the surface of the finished leaves will be $192 \div 75 = 14,400$ square inches or one hundred square feet per ounce troy. This is by no means the ultimate degree of attenuation, for an ounce may be hammered so as to cover one hundred and sixty square feet; but the waste incident in this case, from the number of broken leaves, and the increase and nicety of the labour, makes this an unprofitable refinement." The leaves are, after the last beating, placed in small books of soft paper, each sheet of paper being previously rubbed with red chalk to prevent the gold leaf from adhering to it. In this way it is bought in shops. Silver, copper, and platinum leaf is made in the same manner; but different manufacturers slightly modify the process, as will be found by consulting any work written on the subject.

CHAPTER X.

THE MANUFACTURE OF THE HOUSE PAINTER'S COMBS AND BRUSHES.

IN the practice of any art, the possession of suitable and well-constructed tools is scarcely second in importance to that of obtaining a good and proper material. The truth of this statement will be admitted by all artizans; and we use that word to include every person who is engaged in producing, whether for pleasure or profit, that which cannot be effected without a skill similar to his own. One branch of knowledge connected with every trade, must, therefore, be an acquaintance with the tools which are used in it; and yet it must be admitted that the knowledge obtained is little more than could be derived by an intelligent stranger from a short conversation with a workman. How they are constructed is never an object of inquiry; and hence it is that inconvenient and inefficient tools are used from year to year, and, in many cases, from century to century, not without complaint it is true, but without any serious attempt to improve them. To the same cause, we may attribute the curious but acknowledged fact, that the improvements occasionally introduced in the manufacture of the tools used in those employments appropriately called handicrafts, do not proceed from the workmen, but from some ingenious person who is employed in the manufacture of the tools, and who is prompted by curiosity or a hope of emolument to correct the evils of which the workmen complain. It is, we are convinced, of the greatest importance that the attention of the artizan should be directed to this subject; for no person is so well suited to direct the construction of tools as the man who is in the habit of using them. Whatever art we may practise, it should be our aim to be as independent as possible of the ingenuity or skill of others; and surely he cannot be considered in this happy state, who is totally ignorant of the construction of the tools he is employing, and is, consequently, unable to improve them, when he finds them inefficient for his purposes.

The tools employed by the house painter are few in number, and exceedingly simple in their construction; and there is, perhaps, less need of altering them than those of any other artizan. They consist of brushes and combs, and are made of all the sizes and shapes which can be required by the workman. But, although there seems no immediate opportunity of improvement, the intelligent reader will be anxious to know the various purposes for which they are employed, and the mode in which they are manufactured, and this information we shall attempt to give in the following pages of this chapter.

BRUSHES.—The brushes used by the house-painter are of two kinds, the round and the flat, and are made of various sizes and of different substances, according to the nature of the work to be performed. The substances most commonly used in the manufacture of the house-painter's brushes are sable, camels-hair, and hogs-hair; the several varieties are known by different names, according to the purposes for which they are employed, and of these it will be necessary to give a general description.

The brush called a *duster* is the commonest kind that is made for the use of the house-painter. It is a large round brush, and is used for sweeping away the dust or dirt that may be hanging on the face of the work, previous to painting. It is made of hogs-hair and whalebone, and of the latter there is usually a very large proportion. *Ground-brushes*, so called because the ends or tips of the hair are rubbed down, are similar in appearance and manufacture to the dusters, but should be entirely composed of hogs-hair of fine quality. An inferior article is frequently offered for sale under this name, but the painter will soon be able to detect whether whalebone has been employed, for that substance may be easily split into a number of distinct threads, which cannot be done with hair. The ground-brushes are made of all sizes, and are used by the painter according to the work to be performed. The dusters, when they have been for some time in use, may be employed as paint brushes, for inferior kinds of work, as the rough and sharp ends of the hair are then worn down.

The small brushes with which window-sashes are painted, and mouldings picked in, are called *sash-tools*. They are made of the same hair as the ground-brushes, from which they differ only in size.

The broad flat brush, used for colouring walls and ceilings in distemper, are called *stock-brushes*. The plasterer uses a similar brush, but it is both

larger and coarser, and has three or four ties, whereas the stock-brush has never more than two.

These are the only brushes employed by the house-painter for common work; but in graining and marbling, a greater variety of tools and of superior quality are necessary. As this is an art requiring much attentive study and some natural talent, the character of the work produced even in the hands of the best artist must greatly depend on the suitability and quality of the tools. An accurate acquaintance with these may therefore be considered as the foundation of the art, and must be acquainted by all who are about to attempt this branch of house-decoration.

The rubbing-in brush is similar to the ground-brush, and serves the same purpose to the grainer as that brush does to the painter in plain colours. The *modeller*, so called because it is that with which the character of a wood is obtained, is a flat brush of superior quality, varying in size from one to six inches. Some modellers are made of camels-hair, and some of hogs-hair. The camels-hair brushes are used for satin-wood and mahogany, in which it is necessary to take out a sharp light, and a soft brush enables the artist to obtain a cleaner face on his work. The hogs-hair brushes are well adapted for maple and rosewood, in which the lights are less bold, and more softened out of the dark shades. The hair of a modeller is from half an inch to two and a half inches in length, according to the size of the brush and the nature of the work for which it is to be used. The cost of a camels-hair modeller is about a shilling an inch, and the hogs-hair about sixpence.

The brush used for giving an uniform and smooth face to a piece of graining or marbling, is called a *softener*. It is generally about five inches in width, and the hair is from two and a half to three inches long. It consists of a treble row of ties, about the size of large camel-hair pencils, of which there are commonly seven in each row. For woods, the finest badgers-hair is used; and, for marbles, the best white hogs-hair. The latter has been but recently introduced, but is much approved of by experienced workmen. The greatest objection to the badgers-hair brushes is the circumstance of their being soon clogged up when working in oil colour.

The finishing brush is called an *over-grainer*, and is made of sable, camels-hair, or hogs-hair. The sable brush is used for the finest work, such as imitations of maple and satin-wood; the camels-hair is more suited for mahogany, oak-root, and pollard-oak; the hogs-hair for rosewood, elm, elm-root, and

wainscot. Over-grainers are made from one to six inches wide, and the hair is fixed in a tin ferule. The sable and camels-hair, are from one and a half to two inches long, and the hogs-hair from four to five. The hogs-hair brushes are found to be exceedingly suitable for some kinds of work, from their having a greater stiffness and elasticity than other hairs, and from being sufficiently long to enable the workman to carry a good sweep, and thus better imitate the grain of certain kinds of wood.

Quill tools are made of fine hogs-hair, and are in every respect similar to pencils, but are larger. They are used in graining pollard oak, and oak-root. Pencils of various sizes and kinds are used in both graining and marbling.

To have his tools fit for use, the painter must be careful to keep them clean. When a brush has been used in oil colours, it should be first well washed in turpentine, and then in soap and water, afterwards cleansing it thoroughly in pure water, before it is put away. When distemper colour has been used, it will be sufficient to wash the brush in soap and water, afterwards cleansing it with pure water. Painters, however, are not so careful of their tools when they have been working in distemper, although it is certain that by this precaution the brushes last longer and better keep the spring, which is essential to a good tool.

In the manufacture of brushes of all kinds, the most important object is to fix the hairs in such a manner that they may not be loosened by use. A patent was taken out by a Mr. Mason in 1830, for a better method of fixing bundles or knots of hair into the stock or handle of brushes. The method before in use was that of drilling holes into the stock, and the improvement consists in forming grooves of that form called dovetail, or in other words wider at the top than at the bottom. One end of each bundle of hair being dipped into cement is forced into the groove, and the bundle itself is pressed into an oval form, which causes the extremity to spread out into the wider part. This is the greatest if not the only improvement that has been made in the manufacture of brushes.

COMBS.—Combs are used by the painter in imitating the grain of wood. They are usually made of bone, and vary in size from one to five inches, but may be constructed to order of any width that is required. The teeth are generally from two to two and a half inches in length. In selecting combs, the workman generally takes those which are of a uniform colour, as being

less liable to break than those which are stained; but he must in a great measure depend upon the character of the maker for a good article. They are in price about threepence half-penny an inch.

Combs are sometimes made of cork and leather, the latter being generally preferred. These are cut out by the grainer, of such shapes and sizes as he may require for his work. The sole of a shoe, which has been much worn, is an excellent material. Leather combs are chiefly used for dark wainscot, but are especially useful in graining ceilings, as they bend easily to the mouldings. They are made by simply notching the edge of the leather, leaving a narrower or wider tooth as required. In graining a low ceiling for example, the teeth of the comb must be narrow; in preparing one which is high they must be wide.

Combs are made of various materials, such as wood, horn, bone, tortoise-shell, ivory, and sometimes metal. To prepare a piece of horn, bone, or tortoise-shell, for the comb-manufacturer, it must be softened and pressed between moulds, and as it hardens it will permanently assume the shape required. It is then reduced by a file or rasp, and the situation of the teeth is marked. The cutting of the teeth is performed with a double saw, formed of very thin but well-tempered slips of steel. The steel slips are mounted in a suitable stock, at such distances as may be required for the cutting of the comb. Another method of making combs is by circular saws in a lathe. But the most recent improvement is that proposed by Mr. Lyne, and consists in cutting the teeth with chisels by pressure. The contrivances adopted in this process are exceedingly ingenious, and the mode itself is preferable to all others.

CHAPTER XI.

HOUSE-PAINTING IN PLAIN COLOURS.

THE various processes of painting in plain colours are so simple that a short description will be sufficient for an explanation of the art, both for the reader who may examine these pages for the mere purpose of gaining a knowledge of house-painting as a matter of curiosity, and for him who studies them with the intention of giving a practical application to the information he may acquire. To explain the subject in a manner intelligible to every reader, it will be desirable to state in the first place what ought to be done in painting new work, and then to explain the methods which should be adopted in work which has been before painted. This division of the subject will greatly facilitate our descriptions, and at the same time enable the reader better to understand the nature of the processes that are adopted, and their necessity.

It is hardly necessary to remark that no surface is in a fit state to receive paint which is not perfectly dry. This is a fact universally acknowledged by all painters, and yet in practice strangely or criminally neglected. It is not an uncommon thing to see the walls of good rooms blistered by the injudicious application of oil colour before they were dry, and this so frequently happens that it is almost impossible to avoid the conclusion that in many instances the painter has been induced to commence his work merely for the sake of obtaining an engagement and making a profit, without any regard to the ultimate injury inflicted upon his employer. In the case of walls which have been stuccoed for paint, it is easy to detect whether they are sufficiently dry or not, but it is not always possible to determine whether the wood-work has been sufficiently seasoned. The effect, however, will be in both cases the same. The surface of the material, whether it be wood or plaster, being covered by paint, the moisture which is contained within it is prevented from escaping, for it is impervious. It will, therefore, after a short time,

force up the paint from the surface it covers, blisters will be formed, and the paint will peel off, to the great and permanent detriment of the work. This will be especially the case when it is exposed to the more powerful and direct rays of the sun; but under all circumstances the painter must be cautious not to commence his work upon a substance which contains any degree of moisture. Instances of the effects produced by a disregard of this indispensable precaution might easily be adduced, but every person who has directed his attention to the subject of building, must be acquainted with many of a similar nature to those which we should mention were it necessary.

When new wood is to be painted, the first process is that which is called knotting, the object of which is to prevent a stain upon the finished work, by the passage of the turpentine contained in the knot, through the several coats of paint. There are many methods of effecting this, some of which are found to be more efficacious than others, but they will all require description. The most common mode of knotting is to cover the defective part with a composition formed of red-lead, and a small proportion of white-lead, and whitening made into a thin paste with size. Japanner's gold-size is sometimes used instead of the common size, but the latter is usually and we might perhaps say always, found sufficient, for when there is any doubt it applies to the composition altogether, and not to the mode of preparing it. Knots are sometimes covered with gold-leaf, and this is a very certain preventive, so that in the best work it is almost universally adopted. Another mode is to cut out the knot to the depth of about a quarter of an inch, and to fill up the hole thus made with a hard stopping, composed of white-lead, and one third part of japan, with sufficient quantity of turpentine to make a stiff putty. In about a quarter of an hour, this composition will become hard, but it is desirable that it should be left for four and twenty hours, when it may be rubbed down. A smooth surface being obtained, it may be painted over with certainty. The workman must be careful to paint the opening made by cutting away the knot before he applies the composition, for it will otherwise have no adherence, but fall out immediately it becomes dry.

Priming is the next process, which consists in covering the surface to be painted with a first coat, consisting of white-lead, with a small proportion of red-lead in linseed-oil. A small quantity of some drier is also introduced. This must be done before stopping the work, for if the putty used in the process of stopping be introduced before the first coat of colour is laid on, it will become quite loose when dry.

A smooth and finished surface being obtained by stopping, a second coat must be given to the work. This second coat consists of white lead and oil, with about one-fourth part of turpentine. If it be intended that the work should have four coats of paint, it will be desirable that there should be in the second, some approach to the colour required; but if only three are to be given, it will be indispensable. It will not be expected that we should give any direction as to the mode of applying the colour, but it may be stated as a general direction, that the panel should be covered with a brush not too full of paint, and in "laying it off," there cannot be too little in the brush, or it will ooze out in one place as it is taken up in another.

When the second coat is thoroughly dry and hard, the work should be rubbed down with glass paper, and thoroughly examined to ascertain whether any stopping or facing be required. Work which is to have three coats and flatting, must be grounded with a colour a few shades darker than that in which it is to be finished. The flatting must always be lighter than the ground, or it would, when finished, appear to consist of a series of shades and stripes. The colour used in flatting is mixed with turpentine, which is, by exposure to the air, evaporated, leaving a thin coat of pigment. Hence it is that if the ground were lighter than the flatting, it would shine through, but being darker, a uniform colour is obtained upon the finished surface. The flatting should therefore be, when dry, a shade lighter than the ground. The ground colour should be prepared with at least two-thirds of oil, and, of course, the other third turpentine. If it be intended to apply four coats, the third should be worked with a little more turpentine than would otherwise be required; for a uniform glossy surface is necessary to flat upon, and two coats of strong oil colour cannot be placed one on the other.

Flatting is performed with white lead and turpentine, to which a little copal varnish is sometimes added. When any ornamental design is to be painted on work which has been flatted, the introduction of copal is absolutely necessary, for the colour would otherwise sink into the work, and be less easily applied. Flatting must always be executed quickly, and the brush should not be carried across the panel, or at all events not more than once. The less the work in flatting, the better will it appear when finished. The object of flatting is to prevent the gloss or glaze which always attends work executed in oil, or in other words to obtain a flat, dead appearance. But the advantage is not confined to the appearance of the colour, for it hides all the defects in the wood or other material that is painted. But when there is much work in the flatting, shades are produced, and the dead, unglazed surface is not obtained.

These general remarks upon the process of house-painting, will direct the

reader as to the mode in which the work should be performed, but no amount of reading can make a workman. He may be directed as to the mode of proceeding, but nothing else than practice can enable him to become a painter. The hints we have thrown out are in themselves valuable and of constant application, and may be said to comprise the principles of the art. We have already explained the necessity of having a substance thoroughly dry before it is painted, and it is equally important that every coat of paint should be quite hard before another is applied, and more especially when the work is at all exposed to the sun. The painter will soon be able to detect by inspection whether his work is in a fit state for colouring in oil; but in applying the first coat it may always be known with more certainty, for the paint will be absorbed by the wood or plaster, when the material is quite dry.

Having described the manner of painting new work with any number of coats, it will be necessary to explain the mode of proceeding when it is required to cover a surface which has been before painted. The stiles of doors and shutters are sometimes in such an exceedingly greasy state, as to prevent the application of oil colour; under such circumstances they should be washed with turpentine. Supposing the work to be in a tolerable condition, the first process is to rub it down with pumice and water, until a perfectly smooth and even surface has been obtained. If it should be from any cause in such a state as to prevent this being done at a moderate cost, so as to make when finished a good piece of work, the paint must be entirely removed. There are two modes of doing this. The paint is sometimes burnt with hot irons, and then scraped off. It may also be done by the application of American potass. This alkali is mixed with water so as to form a paste, and the surface is covered with it. Immediately the paint is softened, the potass must be washed off with hot water, and the paint be scraped until it is entirely removed. In the use of this substance there must be great care, for if it be allowed to enter the wood, it will effectually destroy the paint which may be subsequently applied, often making its appearance through four or five coats of colour, years after the work has been completed. It is, however, the best and cleanest way when well managed.

The second colouring, a term which is always applied to the first coat in old work, is composed of white lead, oil, and turpentine, with the pigment required for the colour that may be wanted. Some painters use two-thirds of turpentine and one-third of oil; others employ three-fourths of turpentine and one-fourth of oil. It is not possible to use oil alone, in painting upon old work, for the paint would not then harden completely, and be always liable to peel off. In all the subsequent coats of colour, the painter proceeds as in new work.

Claircoling consists in using a colour with size instead of oil, and it is sometimes, though very improperly, used instead of a coat of oil paint. The object of those who employ size in this manner, is to save one or two coats of paint, which it does by preventing the colour from sinking into the wood or plaster. This mode of performing work is so objectionable, that we might without impropriety omit the mention of it altogether, but on the other hand there may be an advantage in explaining it, so as to enable the reader to detect any imposition which may be attempted. The work, if new, is first primed and then claircolled, after which it is painted in the usual manner. If it be applied to old work, it is used instead of rubbing down, and two coats of oil colour upon the claircoling will make it look as well as three coats upon work which has been properly rubbed down. The use of size, or a colour in size, as a ground for oil painting, is objectionable, because the paint will always peel off, and frequently chip. It is done in inferior work for the sake of cheapness, but the painter who adopts it in any case without fully informing his employer of the objections to it which we have mentioned, is guilty of injustice, if not of deception; for, although it may enable him to perform his work at a very low price, it is ultimately injurious.

The painter is sometimes required to prepare a very defective and uneven surface for painting, and in this case it is necessary that he should be acquainted with the best mode of proceeding. New wood or plaster, is expected to be in a fit state, but surfaces which have been before painted are often so rough that if they were painted again without some preparation, the best work would be unsatisfactory. If, for example, the walls of a dining-room or any other apartment, had been blistered by the application of oil-colour before the walls were dry, they could not be re-painted until prepared, for by the peeling off of part of the colour the surface would be uneven. The same effect may result from a variety of other causes. The cement used in such cases in filling up, consists of Oxford ochre, japanner's gold-size, and turpentine. It is not an uncommon thing to use three or four coats of this substance upon the second coat of oil-colour, in the best work, and especially in drawing-rooms which are to be very highly finished; for when it is carefully rubbed down, a fine glassy surface is obtained. In graining maple and satin-wood, which show every defect of surface, this process is peculiarly advantageous. Coach bodies are prepared in the same manner.

CHAPTER XII.

ON THE IMITATION OF WOODS AND MARBLES.

It was customary in ancient times, and indeed the practice is still adopted among some nations, to decorate the houses of the noble and the rich with costly woods and marbles. The propriety of this mode of decoration is admitted by the most refined nations of Europe; but in this and some other countries, the art of graining has been brought to such perfection, that it is now no longer necessary to incur an enormous cost in obtaining substances which may be so well imitated, as to evade the detection of an experienced eye. It is even doubtful whether it would be desirable to select many of the fancy woods for house decoration, in preference to the imitations which are produced by modern artists, if they could be obtained at the same cost; for not only would many of them be unsuited as regards their properties, but a more equal character is obtained by graining. If the real wood were employed, it would not be possible to select all the best specimens; but the grainer takes these for his models, and produces throughout that which may in one sense be called a flattering representation of the thing which is imitated.

The improvements which have been made in the art of graining, and the small cost at which it is executed, have been the means of introducing it into almost all modern dwellings. The painter who is not capable of this branch of his business must therefore feel himself almost ignorant of his trade, and however long he may have attempted to practise it, he must either begin to study this art, or be content to acknowledge himself less skilful than other workmen in his own calling, and continue to take the inferior, and consequently less profitable parts of house-decoration. To those who are studying the art of imitating woods and marbles, the following remarks will be of great assistance, for although excellence cannot be attained without long practice, much time will be saved, and many disappointments be avoided, by adopting a proper course of study. We shall therefore first explain with some particularity, the mode universally adopted in all graining, taking wainscot, which although the most difficult to execute with

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taste, is the most common, as the example; and then proceed to describe the peculiarities of practice in the several kinds of wood which are more or less frequently introduced.

I. *The Process of Graining some Woods.*

WAINSCOT. *Specimen No. 1.*

New work must always have at least three coats of paint, before a ground is prepared for the graining; and it is always advisable to have four, if the sum to be expended will admit of this slight increase in the cost. If the work has been before painted, two or three coats will be found sufficient. The ground, which does not in any respect differ from the previous coats of painting, must be brought up to that colour which is characteristic of the wood to be imitated. The ground for wainscot consists of white lead and such a proportion of ochre as may be found necessary to give the tint required.

Graining wainscot in oil.—The graining colour consists of oil and turpentine in equal quantities, stained with Turkey umber to such a tint and shade as may be required. To this a little bees-wax is added for the purpose of giving consistence to the colour, so that the ridges which are formed by the combing, may be retained. If the bees-wax were not added, the colour would spread, and a uniform surface be formed by the flowing liquid as soon as the tool was removed. The method of proceeding is to cover the panel with the graining colour, and then to comb it. The most common and the best way, is to form the wave with the first comb, and to draw the second and third comb straight. But there are some workmen who form a waving line with all the three combs. There is another method of graining wainscot by the use of only two different sized combs, beginning with the coarsest. To take out the lights which give the character to the wainscot, a piece of cloth or leather is placed over the thumb, and the colour is removed in such places and masses as the taste of the painter may direct.

Graining wainscot in distemper.—The graining colour for wainscot in distemper, is made of turpentine, Paris-white, and umber, with a small proportion of turpentine varnish, which serves the same purpose as the wax in the graining colour for wainscot in oil. When a panel is covered with it, the combing is performed in the manner already described, but it must be done without loss of time, as it dries very quickly. The lights are then taken out with a camels-hair

pencil moistened with turpentine, the parts thus wetted being immediately rubbed with flannel.

The next process is that of glazing. This colour consists of vandyke brown and raw sienna, with beer as a medium, and they are mixed on the palette. The panel is first moistened with beer, and the colour is then put in as dark as may be required, the shades being thrown across the work. Some grainers prefer to lay in the whole panel, and take out the lights with a sponge. The work is then softened with a brush called a softener, from the purpose for which it is employed, as already described. When the work is quite dry, it is over-grained with the same colour. Care must be taken that the over-grainer is not too full of colour, and the brush must be drawn in a straight line down the panel. When this surface has been softened, the work will be complete.

DARK OAK. *Specimen No. 9.*

The ground for dark oak is formed of white lead, ochre, and umber. The mode of graining is the same as that we have described for wainscot. The graining colour is made from vandyke brown and burnt umber.

POLLARD-OAK. *Specimen No. 4.*

The ground for pollard-oak is formed of white lead, stained with burnt ochre. The graining colour consists of burnt umber and burnt sienna.

Pollard-oak is always grained in distemper, and the following is the mode of proceeding. Moisten the panel with beer, stained to the colour required. Then take a suitable tool, and lightly draw it up the panel, taking care so to vary the line as to leave room for the centres or knots. A flat hogs-hair brush is found to be most convenient for this purpose. The knots, which are always thrown into clumps, are formed with a quill-tool, by turning it quickly round when full of colour. The over-graining is the next process, and this is thrown round the knots. When softened, the work will be complete.

ROSEWOOD. *Specimen No. 2.*

The ground for rosewood is formed of burnt ochre, chrome-yellow, and a small quantity of scarlet-lake, to give brightness. It is always grained in distemper, and the graining colour is made with vandyke-brown and blue-



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Book

Book



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Roswood

Coma



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Salus Wood

black, the latter in a very small proportion. The panel is first covered with beer and a little colour. The dark lines and shades are then put in with a tool, a sufficient open space being left for the grain. The lights are wiped out, where required, with a sponge, and the work well softened. When the work is quite dry, the grain is introduced with a small grainer, the direction of the lines being varied so as to form the characteristic curves, taking care to prevent the grain from passing over the dark shades. The necessity of this will be at once perceived, by an examination of any good specimen of the wood, for although the grain may curve and come up to a dark shade on one side, it does not continue in the same direction, or with the same regular curve on the other. The fine graining is put in with a small camels-hair pencil, and in the wider spaces with a fine grainer.

MAHOGANY. *Specimen No. 3.*

Mahogany is usually grained in distemper. It may be done in oil, but takes a much longer time, and the appearance when finished is not better than that which is executed with beer, as the medium of colour. The process, however, is the same in both cases, so that our description of the mode of graining in distemper will be equally applicable to that in oil.

The ground is formed of chrome-yellow and burnt ochre, brought to the colour required by the addition of white-lead. The graining colour is formed of Vandyke brown and burnt sienna, in equal quantities. Lay over the panel with the graining colour, and proceed to form the feather, which is done with a sponge, taking out sufficient lights on both sides, leaving the centre quite full. Then, with a small modeller, form the centre of the feather, and soften the work with the brush that is used for that purpose. The over-graining is performed with the same colour.

SATIN-WOOD. *Specimen No. 5.*

The ground is formed of white-lead, and a pale chrome yellow. The graining colour, which is always distemper, is formed of raw sienna, with a very small quantity of Indian red. Cover the panel with beer and colour, of the tint required, and proceed to form the feather with a sponge, in the same manner as mahogany, but keeping it smaller and finer than in that wood. The modeller is then drawn down the panel, to break the even edge

of the dark line. When the work has been softened, it is grained over the feather, in the same manner as mahogany. The character of satin-wood may be described as a composition between maple and mahogany;—the modelling is that of maple, the feather that of mahogany.

MAPLE. *Specimen No. 6.*

The ground for maple is formed of white-lead, chrome yellow, and a small quantity of vermilion. It is always grained in distemper, and the graining colour consists of raw sienna and Indian red. The panel is first laid over with beer and colour, and the modeller is then drawn down the face of the work, in a waving direction, leaving the open space where the heart of the wood is intended to be introduced, rather darker than the other parts. In modelling maple, the pressure of the hand must be regulated by the taste of the workman. Where the weight of the hand is withdrawn, dark shades are left. The eyes are formed by placing the tips of the fingers upon the work while wet, after which it is well softened. When the colour is dry, which will be in a few minutes, the heart of the wood is put in with a sable or camels-hair pencil, Indian red being used as the colour. The sable over-grainer, when charged with colour, is combed, a common pocket hair-comb being suitable for the purpose, and the tool is thus divided into a number of small pencils. In this state, it is drawn down the panel, by the side of the heart, and well softened. A small circle is afterwards formed round the eyes, with a camels-hair pencil, with over-graining colours, and the work is then complete.

SYCAMORE. *Specimen No. 7.*

Sycamore is sometimes used for the stiles of doors, when the panels are grained maple. This is not an universal practice, and in the present day can scarcely be called a common one; but as it is occasionally adopted, it will be desirable to describe the mode of graining this wood.

The ground for sycamore is formed of chrome-yellow, with such a proportion of white-lead as shall give the colour required. The graining colour consists of raw sienna and burnt umber. The modeller is drawn down the panel with sudden and quickly repeated jerks of the hand. The work is then softened across the panel, and when dry it is over-grained in nearly the same style as the feather of mahogany.



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Chaple



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Lyons



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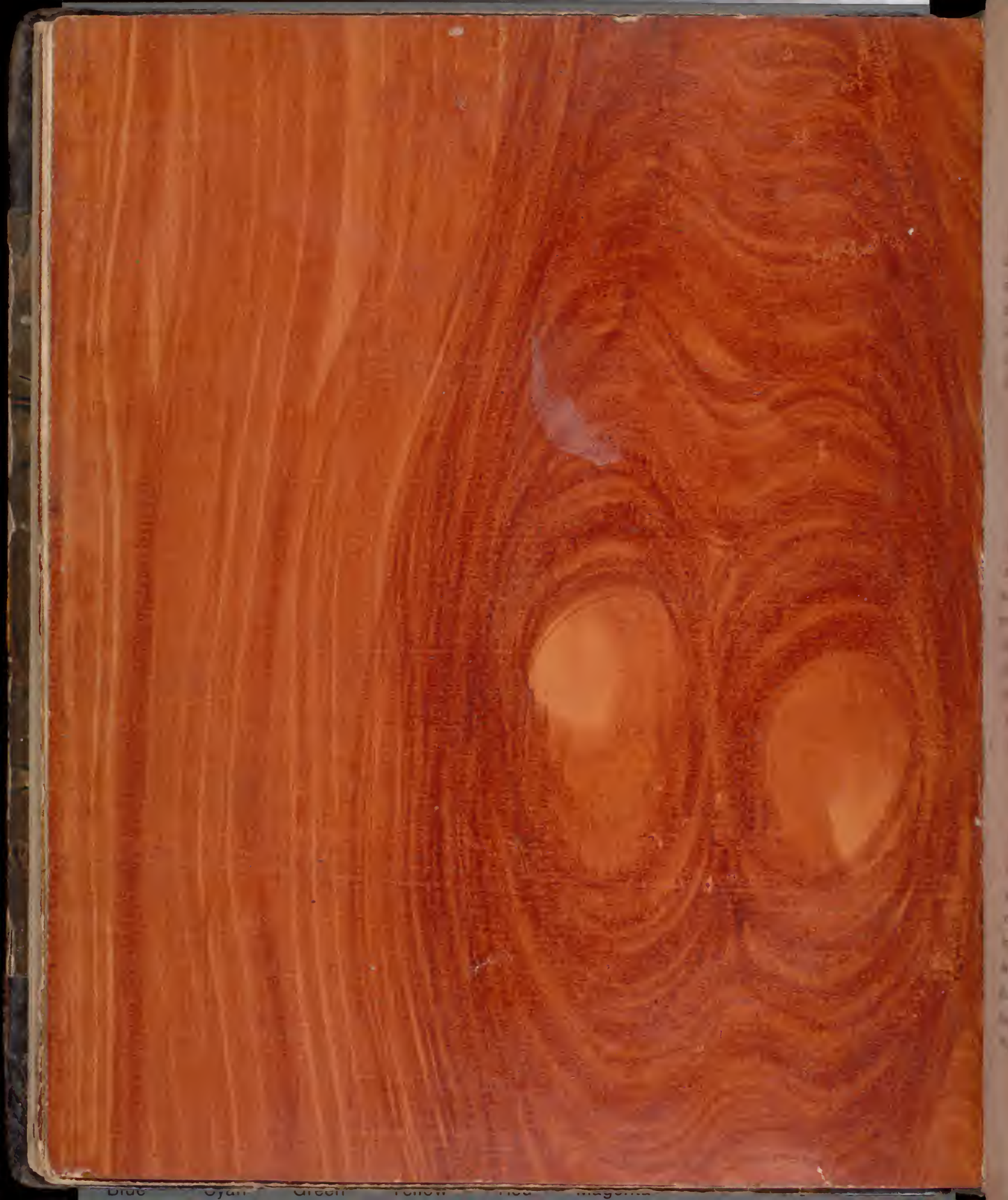


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Yale Wood



ZEBRA WOOD. *Specimen No. 8.*

The ground for zebra wood is formed of Venetian red, chrome yellow, and umber; the graining colour, of black and umber. The panel is first laid over with a light glaze of the graining colour in water, for no beer is used in the imitation of zebra wood. When the glaze is partly set, the wave or centre is formed with the over grainer. In seven or eight hours the work will be dry, and the whole panel, excepting the centre, which must be left light, is then again glazed in the same manner, and softened.

WALNUT. *Specimen No. 10.*

The ground for walnut is formed of white lead, ochre, and Venetian red; the graining colour of Vandyke brown. The panel is first laid over with beer and the colour required. When the work is dry, dip the over-grainer into beer containing a little colour, and comb it. Then form the heart with a quick sweep, and soften it with the brush commonly employed for that purpose. This throws up not only the colour which was last put on, but also the one beneath it. Having proceeded thus far, put in the dark shades by the side of the feather with a quill tool, softening as usual. When this is dry, lay over all the work with a very thin colour, and flog it gently, which may be done with the softener, striking with the flat side of the brush. The face of the work is then drawn up with the end of the tool, which completes the process of graining walnut.

TULIP WOOD. *Specimen No. 11.*

The ground for tulip wood is formed of burnt ochre with white lead, the latter being used in all cases to form the colour of the tint required. The graining colour consists of two parts of Indian red, and one part of Vandyke brown. First damp the panel, laying on a little colour, and with a small grainer, form a grain similar to that of rosewood. Then produce dark lines down the sides of it, and sponge the ground between them, so as to obtain the necessary lights. The graining is performed in a straight line down the panel. These various processes being carefully performed, damp the panel with colour, and beat it with the edge of the softener.

ASH. *Specimen No. 12.*

The ground for ash is the same as that we have described for oak—it consists of white-lead stained with ochre. When it is to be grained in distemper, the graining colour is formed of black and vandyke. With this the panel is over-spread, and the character is taken out with a modeller. The heart of the wood is then softened, and the whole is over-grained with the same colour.

If the ash is to be grained in oil, the panel is covered in the same manner, but the heart is taken out with a cloth or leather, drawn tightly over the thumb. A suitable comb is then worked in a straight line down the panel, as in over-graining. When this has been done, a splitting comb is drawn sharply from angle to angle, taking care not to pass over the heart. The object of this is to break the straight grain of the former combing. From the description we have given of the mode of graining, as well as from an examination of the woods, it will be evident that oak and ash are very similar, and their imitations differ only in the mode of combing. The oak is formed by a waving line, divided by the straight combing; the ash by a straight line, divided by a line from angle to angle, so that if the straight line in ash were not split by the transverse combing, it would have the appearance of oak.

CEDAR. *Specimen No. 13.*

The ground for graining cedar is composed of white lead and Indian red, with beer as a medium. The graining colour is formed of lake. Lay over the panel a light tint of the colour, and with the tool commonly employed for this purpose, introduce the dark shades similar to those in common deal, but of a different colour, keeping them soft toward the sides. While the colour is wet, draw the over-grainer gently down it, and again soften the edges. When dry, form the centre with a camel's-hair pencil, and put in the knots with japanner's gold-size and burnt umber.

Cedar is rarely introduced by the house-decorator, but from the specimens we have seen, we have little doubt that it would, in many situations, be found exceedingly effective, even in large masses. In one instance with which we are acquainted, a bold staircase was painted in cedar, and the effect was in every respect satisfactory.



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Cesar Wood

No. 14

Harriet



No. 15



Blue

Cyan

Green

Yellow

Red

Magenta

HARE-WOOD. *Specimen No. 14.*

The ground for hare-wood is a light grey: the graining colour, sienna, and a little blue-black. The panel is first laid over with the colour, and the lights are taken out with a sponge. When the work has been softened and is quite dry, it is grained, first in a straight line down the panel, and then across in a slightly waving direction.

KING-WOOD. *Specimen No. 15.*

The ground of king-wood is formed of Venetian red and yellow ochre. The graining colour is made of black and Vandyke, in equal proportions. With this the panel is covered, and the heart is taken out with a sponge, in the same manner as rosewood. It is then softened up and down the panel. When the knots have been taken out, which is also done with a sponge, the work is softened with a badger tool, and the panel is over-grained. The knots are then joined, or set into one another, which completes the process.

II. *The Process of Imitating some Marbles.*

Man, who has, by an intelligent examination of nature, guided by want and curiosity, found in the mineral constitution of the earth, the vegetables which furnish it, and the creatures who inhabit it, all that is necessary for his existence and civilization, collects from the same sources the objects best suited to administer to his pride. From the chieftain of a horde of barbarians, to the monarch of a civilized European nation, all men who have been placed by birth, circumstances, or talent, above their fellow-men, are anxious for some exterior display of their advantages, and among other means of exhibiting their superiority, deck themselves in clothing or ornaments, of such value, that they cannot be obtained by those of inferior rank; or appropriate to themselves the sole possession of some thing or property of things, which, from its connexion with sovereignty or title, derives a fictitious value. The ornaments most esteemed, have been those collected from the mineral kingdom, which furnishes a wonderful variety of beautiful forms and resplendent colours. These gems have, among all civilized nations, been so highly esteemed, that large fortunes

have been expended to purchase them, and even national resources have been exhausted to obtain the stones which decorate the insignia of royalty.

The same love of ornament and desire for distinction, have induced nations and individuals to erect large buildings, of expensive materials, of so lasting a nature, that there was a probability of their enduring the united influence of the elements of destruction for ages, without injury or decay. For this purpose, the Egyptians constructed of granite their enormous monuments, which awe the spectator by their very vastness; and the Greeks, who were more anxious for elegance and chasteness of design than for magnitude, of marble. In more modern times, coarser stones have been employed in construction, and the most beautiful and varied materials have been selected for interior decoration. Marbles, of exquisite richness, have been discovered, and these have been introduced for various purposes in building, but chiefly for the walls of staircases, halls, and saloons, as well as floors, chimney-pieces, and articles of ornament.

It is difficult to give any precise or definite meaning to the term marble, but it may be stated generally that those limestones are so called to which a fine polish can be given. They are not confined to any part of the geological series, but are found among the tertiary, secondary, and primitive rocks. Nor is there any peculiar character distinguishing the marbles of one series from those of another.

The close-grained coloured marbles, suitable for use in the decoration of buildings, are chiefly obtained from primitive and tertiary districts, but they are found, although comparatively rare, among the secondary rocks. The forest marble of England lies beneath the sands and sand-stones of the upper oolite, and has been extensively prepared in Oxfordshire for architectural purposes. The colours with which many marbles are beautifully variegated, proceed from the intermixture of the oxides of iron; but copper, horn-blende, and other substances, occasionally enter into their composition as the colouring matter.

Marbles have been divided into eight classes, and those who are studying them with a view to imitation, will perhaps find an advantage in taking this classification as a guide to their observations.

1. The Uni-coloured Marbles, which are always either white or black.

The celebrated Parian and Pentelic marbles, so much used by the ancients, are of this class. The Parian marble is of a yellowish white colour, and from it some of the noblest works of the ancients were carved, among which

we may mention the Medicean Venus. The Pentelic marble was obtained from Mount Penteles, near Athens, and closely resembles the Parian, but has a finer grain, and is sometimes disfigured by green stripes, produced by the presence of green talc. The Parthenon and other of the finest structures of Greece, were built of Pentelic marble. A very hard marble, of a pure white colour, was obtained by the ancients from Scios, Lemnos, and some other islands of the Grecian archipelago, and was very highly esteemed, being susceptible of a fine polish, and having a close texture. The white marble of Carrara was also used by the ancients, and from the works executed in it, which remain to this day, it appears to retain its colour better than the Parian. The finest quality is now exceedingly rare. The principal quarries are at Pianello and Polvazzo.

The black antique marble is a much more intense black than any modern limestone, but is now only known in the sculptured fragments found at Rome. Those modern marbles which most nearly approach it, are those of Como, and of Bergamo, both of which are susceptible of a fine polish. A useful black marble is found at Ashford and Monsaldale, in Derbyshire. A fine marble of the same kind has also been found at Crayleath, in the county of Down.

2. The Variegated Marbles.

The ancients did not employ so many variegated marbles as the moderns, but those which were chosen by them are exceedingly beautiful. The Egyptum, or red-antique marble, is of a deep blood-red colour, with white streaks and spots. There is a colossal statue of Marcus Agrippa, carved from this marble, in the Grimani Palace, at Venice, which was brought from the Parthenon at Rome. A yellow marble, with black markings, was also much used by the ancients. Many excellent marbles are found in Sicily, of which the Sicilian jasper is the most esteemed. The Italian marbles are exceedingly numerous, and are generally preferred to all others. The Verona is of a yellowish red colour; the Margorre, found in several parts of the Milanese, is of a bluish colour, with brown veins; the Sienna, or Brocatello di Sienna, is a yellow marble, with veins of a bluish red and purple colour. The English marbles are chiefly obtained from Derbyshire and Devonshire; and those from the latter county are distinguished by a singular variety and intermixture of colours.

3. Madreporic Marbles.

Some of the strata forming the crust of the earth, are known to have been the produce of madrepores, and their remains give a peculiar appearance to

the marbles of which they constitute the principal part. These animal remains are generally presented in the form of grey or white spots, with regularly disposed marks in the centre. The *pietra stellaria* of Italy is entirely composed of madrepores, and extensively used in the country where it is found.

4. Shell Marbles.

In this class of marbles, Brard, who proposed the arrangement to which we now refer, included only those which contained a few shells. The Kilkenny marble belongs to this class, as also many of those brought from Derbyshire, and other parts of England.

5. The Lumachelli Marbles.

The Lumachelli marbles are those which are entirely composed of shells. There are but few of them that can be employed in decoration, and the painter is never required to imitate them.

6. Cipolin Marbles.

The Cipolin marbles are those which contain veins of greenish talc; "their fracture is granular and shining, and displays here and there plates of talc."

7. Breccia Marbles.

The Breccia marbles consist of a variety of angular fragments, united by some common base or cement. The *verde antique* is a marble of this class, the fragments consisting chiefly of serpentine, and the cement of talc and limestone. That variety is most esteemed in which the cement is of a grass green colour, and the fragments black, without the intermixture of red spots. The antique African Breccia is one of the most beautiful of all known marbles; it has a black ground, and the fragments are of a grayish white, red, and purple colour. In the Veronese there are some fine Breccia marbles, especially that obtained near the village of Bretonico; it consists of yellow, yellowish white, and rose-coloured fragments.

8. Puddingstone Marbles.

These are conglomerates of rounded fragments of rock. They are not very commonly found, and are seldom introduced in decoration.

If the painter will study marbles in reference to the classification which we have attempted to illustrate and explain, he will find that his labour is much abridged, and his success will be more certain. If the finest works of the masters must be studied by him who aims at excellence in the arts, so the most beautiful specimens of marble must be carefully examined by the painter who hopes to imitate them with correctness and spirit. The examination of small

hand specimens, however beautiful, is not sufficient, for if the attention be confined to these, the artist will certainly fail to obtain that variety of structure and colour which so peculiarly distinguishes those marbles which he is called upon to imitate. There is no sameness in nature; there are generic and specific resemblances,—similarities, but no identities. Man, the most perfect of all created terrestrial existence, is an instance of the truth of this remark: most wonderful are the diversities of form as well as of countenance; yet the similarities are so striking, that from the gross body and sensual expression of the half-brutalized Australian, to the graceful contour and intellectual eye of the ancient Greek, there is a resemblance too strong to admit of the possibility of disuniting them. Descending from the animate and intellectual to matter in its inertness, we might point out the same general resemblance and individual dissimilarity in mineral substances, but the reader may himself trace these characteristics in all that he sees.

To imitate the marbles with success and spirit, the painter must devote much time and attention to the art, for without these every attempt will fail. But as there are few workmen who will do this, it has been found necessary to prepare papers in imitation of the various styles of marble, so that persons residing at a distance from the metropolis, and in situations where good painters cannot be engaged, may obtain the imitations they require. The extensive introduction of marble papers has led to a corresponding improvement in their preparation. We are bound in justice to state that above all others, we prefer the specimens produced by Messrs. Saunders and Woolley, who have prepared the illustrations for the latter numbers of this work. The mode in which these marble papers are produced, has not been made known. They are for many purposes exceedingly useful, but we give a preference to those which are produced by the brush, although in some respects these have the advantage. We have been particularly struck by the variation in the colour and tone of the ground, so as to admit of a natural shading, which we have never seen attempted by hand. There is also a perpetual change in the character and colour of the veining, that gives a freedom and natural appearance, contrasting strongly with the sameness of character too evident in the productions of the brush. The smoothness of surface in the finished paper, renders it unnecessary to rub down the work, as is always requisite in the marbles produced by hand. And, in addition to these obvious advantages, there are those of a saving in time and expense. But, above all, that which most recommends these papers to our notice, is

the more accurate imitation of nature, which is secured by the diversity in the colour of the ground, and the variety in the disposition of the veining. Whether we have given a too flattering description of this new style of marbling, the reader himself will judge, by an examination of the illustrations in this and the preceding part of our work.

GENERAL REMARKS ON THE IMITATION OF MARBLES.

To a person unacquainted with the process of imitating marbles, and who examines a specimen produced by a good painter, the art must appear one of great complexity and extremely difficult to be acquired. There is, perhaps, no branch of house-decoration which requires a greater knowledge of colours or more taste than marbling; but there is so close a resemblance between the execution of all varieties of marble, that when the painter is able to imitate one, he will find but little difficulty with the others. The mode of working is the same in all, but the colours vary; and, in adjusting these, the young painter finds himself most perplexed. His task, however, will be the easier if he first study the art of balancing his colours, so as to obtain a pleasing effect in whatever manner his work is to be viewed. The ultimate appropriation of the thing painted is of the utmost moment, in deciding upon the manner in which the work is to be done. Thus, in painting a column or pilaster, in imitation of a marble, the base and lower portion of the shaft should be darker than the superior parts, so as to give the appearance of a greater solidity, and the work on each side of a pilaster, or round the entire circumference of a column, should be equal, but without sameness. A person who watches the workman, may wonder when he sees the first stroke of the pencil, where the second will fall, and what will be the form of the line; but the painter himself, if he be master of his art, has the finished work present to his imagination, and knows how one line will succeed another, and the means by which the ultimate harmony of the colours will be secured. The importance of studying the harmony of the colours will therefore be evident, but we may take an illustration from the fictitious marble called agate. In painting this substance, four colours are introduced, green, brown, yellow, and red. Now take a number of pieces of cloth of these colours, and place them together promiscuously, and as there is no order there will be no harmony. Then take a panel, and apply to it the same colours in pigments, and having done this, sprinkle a little turpentine upon them, with a sash-tool, and the

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colours will run into each other, and by blending produce a harmonious admixture.

It may seem a strange assertion, but it is deserving of consideration,—that nature must not be followed too closely, for she sometimes indulges in freaks, which present appearances so unusual, that if they were imitated, the imitations would appear caricatures, and expose the painter to the reproach of those who had been less constant or less successful observers than himself. The artist frequently witnesses a colouring in clouds which he cannot attempt to introduce upon his canvas, and forms which, when reduced to his miniature representations, would give to his drawings a grotesque and even ridiculous appearance. So, also, there are in marbles, or rather in some specimens of marble, characters which it would be extremely injudicious to introduce in any imitation. In Sienna, for example, a grey streak or vein will be frequently seen crossing the slab in one direction, and a bright yellow one in another. These must be considered defects, as regards the purpose for which the marble is used in decoration, and ought not therefore to be imitated. There may also be a sharpness or abruptness in a marble, which is not altogether unpleasant, but which in an imitation would, from want of a sufficient transparence, be exceedingly disagreeable. In all such matters, the painter must be guided by his own taste and knowledge of colours. If he has neither the quality of mind, nor the information, it will be impossible for him to succeed as a painter of marbles. A man who is master of the art, can always arrange in his mind the character he is about to represent, before he has even coloured his work; and if he be anxious for success does so, although he may find it necessary or rather desirable, in the progress of the work, to change in some degree the character; in the same manner as an artist, who, when he has formed his first sketch, improves it by a more appropriate grouping, or by giving a more striking attitude to his principal figures.

These general remarks will guide the young painter in the study of his art, and we may now proceed to explain the manner in which the several marbles are imitated.

DOVE-MARBLE. *Specimen No. 1.*

The ground for dove-marble is a warm grey, formed of black, white, and a small proportion of red.

The first process is to lay over the work with a transparent grey colour,

formed of white and black, and made a little lighter than the ground. This colour is made up with maguip, and is well tempered, that it may not set on the hand. To the maguip is added mastic varnish, fat oil, and a very small quantity of boiled oil. With this colour, which is made four or five shades darker than the ground, the character of the marble is formed, a flat hog's-hair tool being used for the purpose. The darker parts are then introduced, and the colours are blended with a hog's-hair softener, which is worked the long way of the panel. The light greys are then heightened with a pencil, white-lead being used for the purpose, so as to give a stronger and bolder character. These are the several processes, but in the execution of the work the painter must be regulated by his taste and knowledge of the principles of harmony, and carefully blend and balance his colours, so that the finished work may present an entire and distinct character.

There is a grey marble which may be readily mistaken for dove, but requires a different process in painting. The ground, which is a light grey, is made of black and white. The work is first laid over with maguip, as in the imitation of dove-marble, but instead of taking the dark lines up and down, they are thrown into a diagonal direction. This being done, the colours are blended with a hog's-hair softener, moving the brush in every direction. Instead of taking a white colour to harmonize with the darks, the character is introduced in a rough manner, and the colours are blended with a softener, which gives great transparence to the work. To heighten the work, a more opaque colour is used, with a pencil, and gently softened with a badger. Having proceeded thus far, a little turpentine and pure white are mixed together, and the work is sprinkled with a clean brush, which has the effect of blending the tints; and the entire surface is then again softened.

VERDE ANTIQUE. *Specimen No. 2.*

Black is the ground for Verde Antique. Mix, in a small pot, blue and yellow, so as to form a brownish green, suitable for the marble. The painter must then provide himself with two or three quill feathers. Having mixed some of the colour upon a pallet, form the character of the marble with the feather, afterwards finishing the work where required with a pencil. Then with a pencil and a lighter green colour, heighten the tone, by a few indiscriminate touches in such parts as may seem necessary.

The Egyptian Verde Antique is a variety of this marble, and may be

No. 3





No. 3



No. 4





distinguished by its more blotchy character. The old fashioned mode of preparing this marble is probably the best. Take a sheet of paper and cut it in strips, leaving on one edge an uncut band, so that it may be rolled up and form a kind of brush. Dip the ends of this brush into a suitable blue colour, and flog the work. Then, with the feather of a quill, form the diversity of character, using a thinner colour so as to obtain a greater depth or transparence. The veins are next introduced with a pencil, in a touchy style, so as to produce the effect. No instruction can be given which will enable the painter to imitate the character of the several marbles; it is only by observation and long-continued practice that the art can be acquired.

A VARIETY OF SIENNA MARBLE. *Specimen No. 3.*

The marble called Sienna differs greatly in character, and this specimen is introduced to show how a skilful painter may vary the character, so as to obtain an appearance in every way true to nature, and yet differing from the marbles in common use.

The ground for this variety of Sienna is a yellow, somewhat darker than that in common use. The character is formed in a transparent colour, composed of burnt sienna and umber, and applied with the feather of a quill, as in verde antique. This being done, the spaces are filled in with a darker transparent colour, and the whole is finished with a pencil, a still darker colour being employed. This is an excellent subject for practice, and one which might be introduced, with much effect, in work where a warm tone of colour is required, and is for many purposes even preferable to the Sienna in more common use for architectural decoration.

JASPAR. *Specimen No. 4.*

Jasper is a fancy marble, and is never introduced in large masses, except in imitation. The ground may be made of any colour that is suitable to the style of work or the situation, but is commonly grey or a yellowish stone colour. The ground being dry, lay over a certain portion of the work with an opaque colour, formed of burnt sienna, and a little Indian red. In about half an hour it will be sufficiently set, and the work must then be sprinkled with maguily and turpentine, a clean brush being used for that purpose; and, wherever the moisture falls large spots will be formed. When this is dry,

the work must be thrown into character, which is done with a yellowish grey colour, by introducing it round the red masses, as may be seen in the specimen. The work must then be heightened with a pure white colour. The peculiar ribbon structure, or waving line, must be afterwards introduced, which is done with the feather of a quill, and has the effect of uniting the red and other colours. This is performed with a pure white-lead, mixed with turpentine, gold-size being introduced in sufficient quantity to give it the necessary binding quality. The work is finished with a pencil, in light and characteristic touches.

EGYPTIAN GREEN. *Specimen No. 5.*

The Egyptian green chiefly differs from the verde antique in the introduction of the black masses of colour, which may be seen in the specimen. The ground is generally an invisible green, made of black and yellow. When the ground is dry, lay over nearly the entire surface with a suitable green, varying the character, which may easily be done, with the feather, so as to admit of the introduction of the black masses. When this is dry, cut up the work with black, so as to obtain the required character. The white masses are then thrown in and touched with the pencil, so as to have on one side a sharp edge, and on the other one that is softened, to represent masses which are only partly exposed. When stones are cut and polished, they are frequently so transparent that we seem to look beneath the surface, and crystallized masses may be observed distinct from the substance which forms the matrix. These crystalline bodies may present their sides, or may be cut angularly, thus giving a singular variety of form and great transparence to the mass. To imitate this, the painter must display all his skill. The inexperienced will at first find some difficulty, and probably make many abortive attempts, but success will follow perseverance.

BLACK AND GOLD. *Specimen No. 6.*

This marble derives its name from its black ground and its gold-coloured veins. There are three colours in black and gold, and to balance them is the greatest difficulty in imitating the marble. The character of the marble is introduced in a colour which blends the qualities of yellow, umber, and red. A warm yellow is next introduced, and this is blended with the colour which forms the character. A third and still lighter tone of colour is lastly



No. 5

Chas Nicholson

February

1844

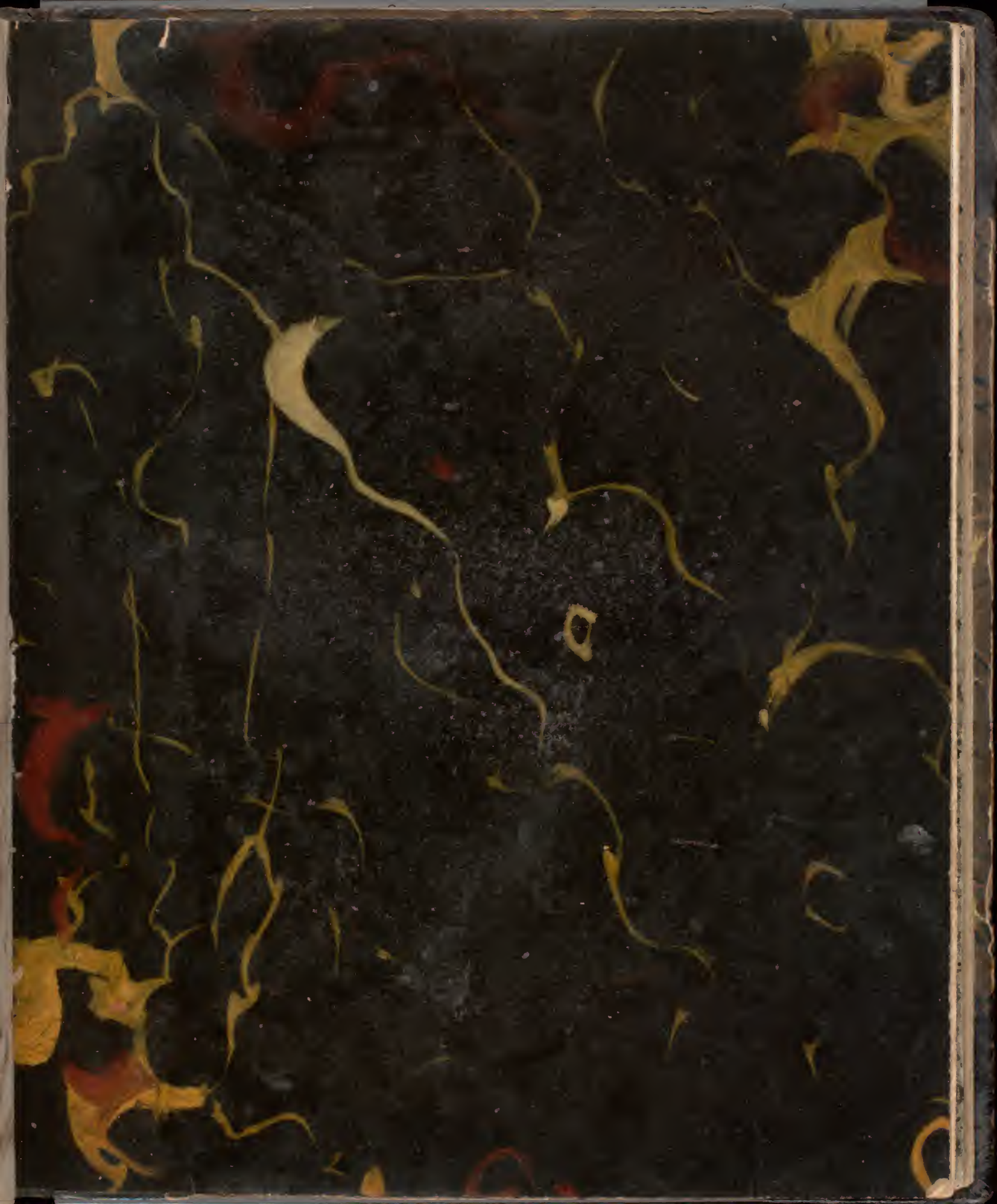
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John Mayer



No. 6

No. 7

John Mayle

Palmer

Palmer



No. 3



No. 9



introduced, to give the required relief. With the middle of these three tints, the small veining is put in, and this is frequently made to finish the work. In the best specimens of this marble, however, the work is cut up with black after the introduction of the veining, so as to throw the yellow masses into more determined figures. When this is dry, the omitted spaces are filled in with a deep grey colour, about two shades lighter than the black.

BROCATILLA. *Specimen No. 7.*

The ground for brocatilla is a light warm yellow, of the same tone as that commonly used for sienna, and is formed of ochre and white-lead. Take raw and burnt sienna, and with maguip make a transparent colour, of the tone required for the marble when finished. With this colour lay over the work, and, in a few minutes after the colour has set, sprinkle it with maguip and turpentine, using a sash-tool for the purpose. This will cause the yellow ground to flow. Then shade the larger blots with a light yellow colour, to show the angular fragments, and give greater depth. A suitable colour, formed of Prussian blue and vermilion, is then prepared, and with a pencil it is used to vein round the angular parts, taking care not to carry the dark lines through the blots.

NORWEGIAN SLATE. *Specimen No. 8.*

The ground for this marble is a grey, tending to amber, and is formed of black, white, and umber. When the ground is dry, form the character of the marble with a feather, in a grey colour, slightly darker than the ground, so as to produce the necessary transparence. Take, then, a still darker colour, and with a feather give the cross shade, so as to obtain depth on the larger parts of the work. The veins which have been left unfinished by the feather, must then be carried out with a pencil in the same colour, and this will complete the imitation.

SIENNA. *Specimen No. 9.*

Sienna marble has a great variety of character. One slab will have a dark hue tending to umber, and another from the same quarry will be a bright yellow. In the imitations, however, the ground is commonly made of a light yellow. The ground being dry, the work is laid over with maguip.

tinged with yellow. While this is wet, the character is formed with a black crayon, and blended with the colour by a softener. The painter then forms a suitable colour on his pallet, with raw sienna, burnt sienna, and other colours; and it is worthy of remark that in this stage of the work he displays his taste, by the selection and introduction of the colours, for upon this choice the success of every future operation depends. The spaces left open by the crayon are then filled in with a colour tending to raw sienna, and the several colours are blended together in the usual manner. When this is dry, the shades are thrown in with a darker colour. The work is then glazed with white, and when badgered is complete.

Some painters, in finishing sienna, spot it with a pure white, but so many neglect this process that it can scarcely be called a common custom. We would strongly recommend those who are beginning to imitate this marble, after they have examined the best productions of other men, to paint from a number of the best specimens they can obtain, before they adopt any particular style.

AGATE. *Specimen No. 10.*

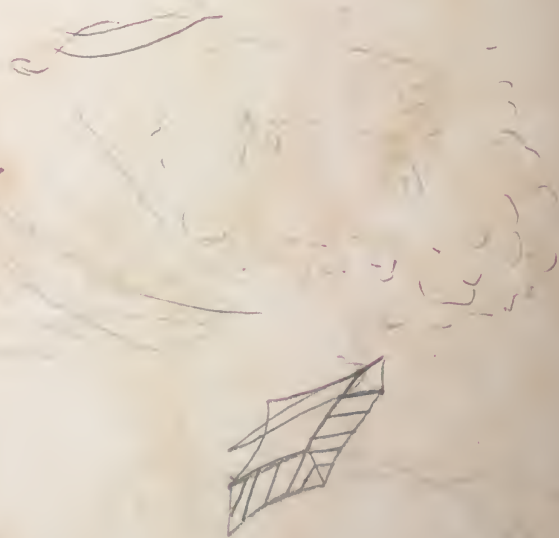
Oil white is the ground for agate. The character of the marble is formed with, a quill, rather long in the feather, in a transparent crimson colour, produced by the union of lake and white. When this is dry, the work is again covered in the same manner with a darker colour containing more lake. The character is then followed out, and a greater variety introduced with a bright medium tone of green, formed by the mixture of blue and yellow. With a sash-tool, dipped in maguip and turpentine, the work is then sprinkled, and all the three colours before used are introduced in places with a pencil, so as to heighten the tone and give effect to the work.

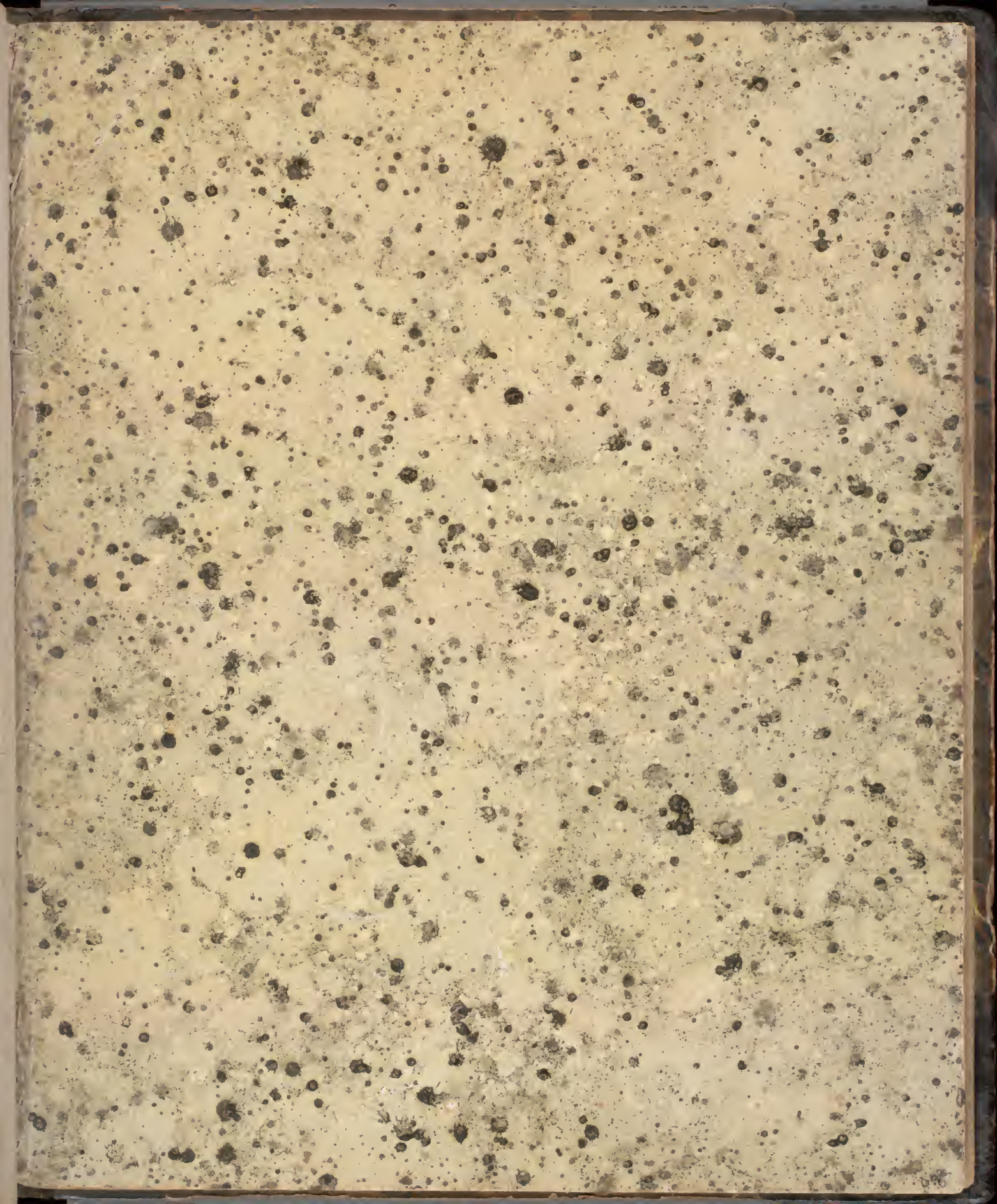
GREY GRANITE. *Specimen No. 11.*

The house-painter very rarely attempts to imitate any other than the common fine-grained granites. The term granite was used in a very indefinite sense, and in fact signified any granular stone, but it has now a more restricted meaning. Granites commonly consist of mica, quartz, and hornblende, or feldspar, and two of these minerals are always present, being necessary to compose the rock. Some varieties of granite contain large crystals or fragments of feldspar, quartz, or hornblende, and these are, as specimens, by far



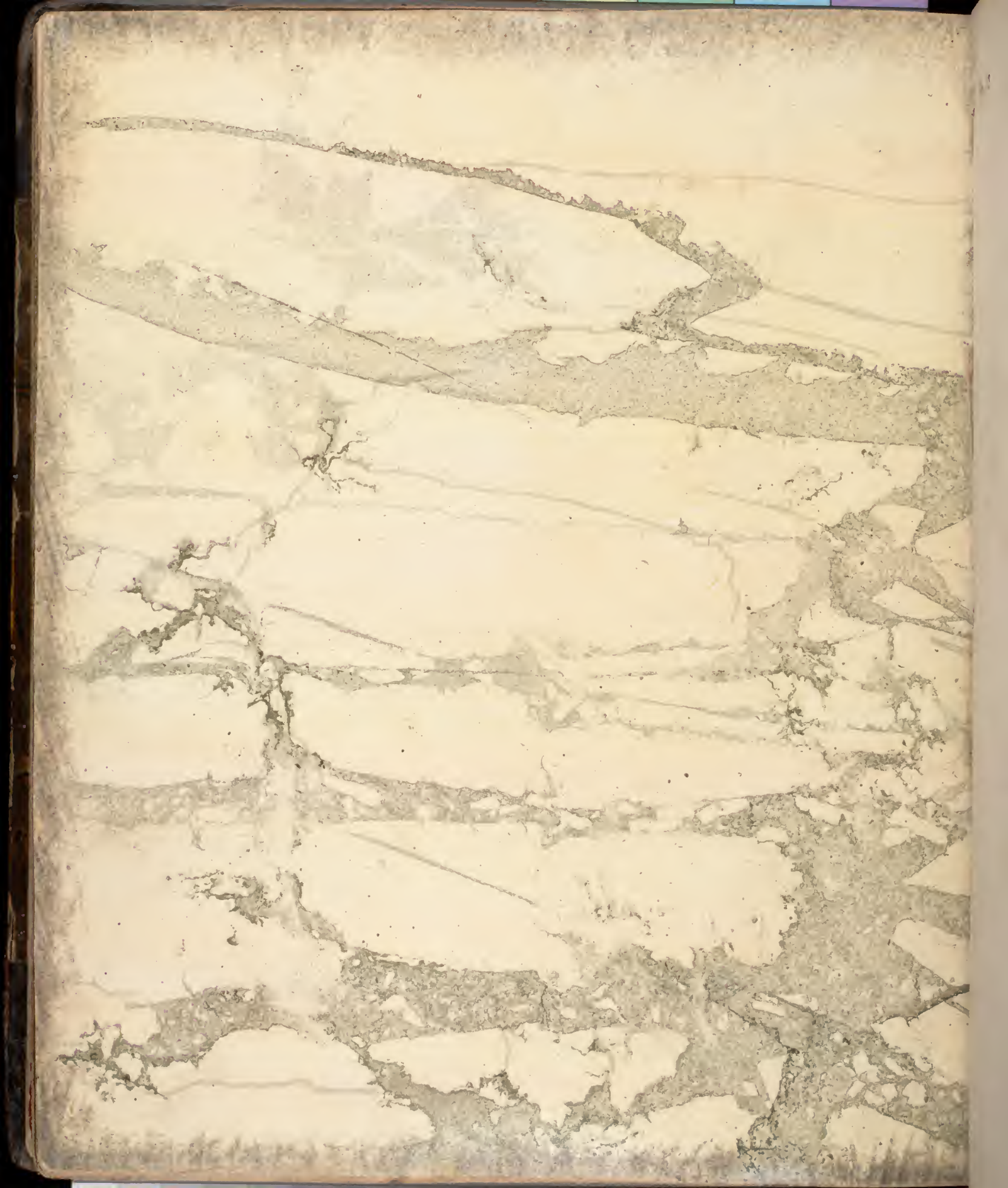
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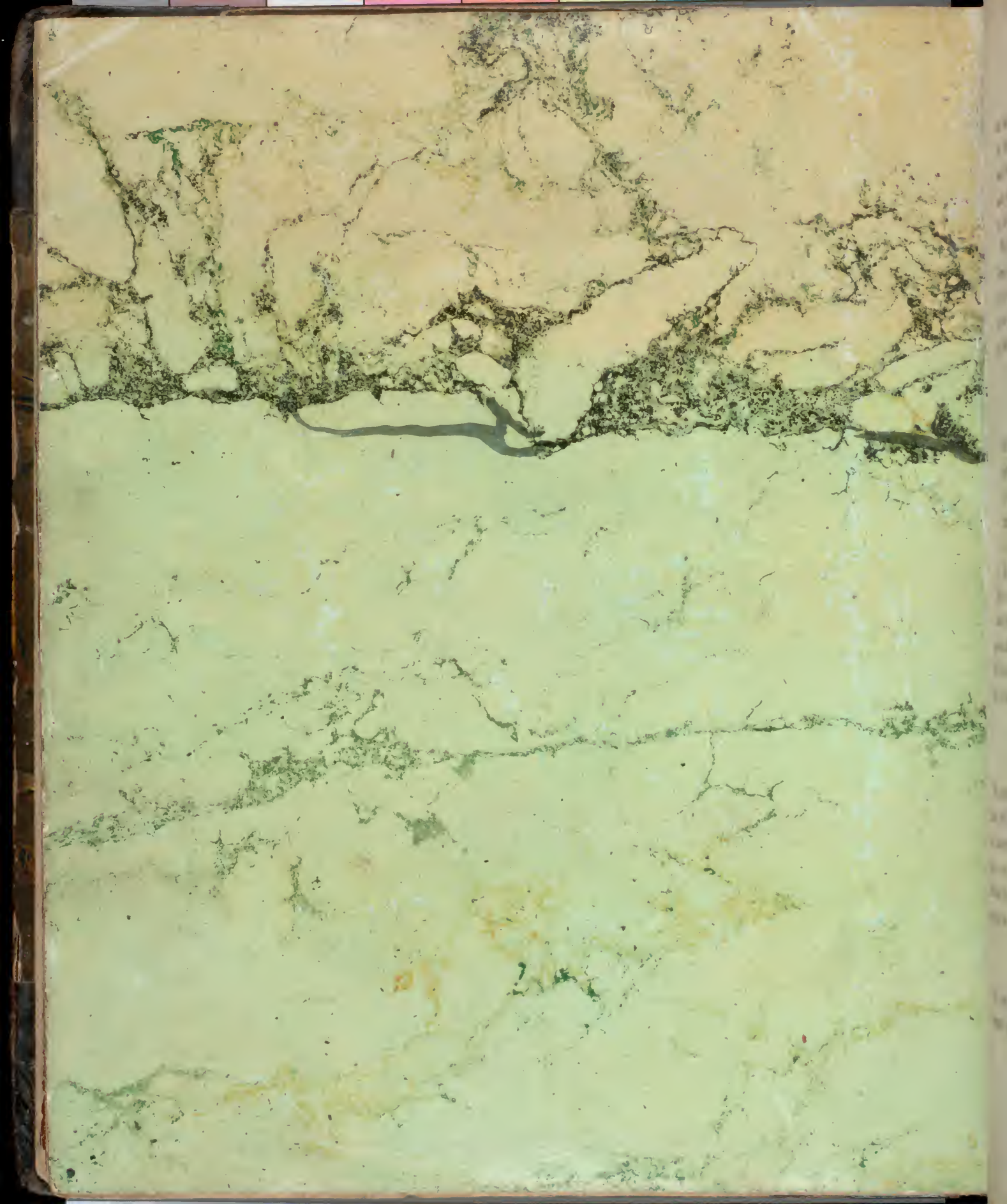
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No. 13



No. 14



the most beautiful. For the imitation of these, greater skill and care would be required, than for the more common varieties, and we have seldom seen them attempted. In all the granites introduced by the painter, the same mode is adopted, the colour of the ground being alone changed, so that our description for grey granite is equally applicable to those of other colours.

When the grey ground is dry, sprinkle the work fully with a darker colour, formed of white and black, and then in the same manner with pure white. It is not often that an attempt is made to imitate the sparkling appearance of the mica, but when this is done, it is by throwing upon the work while wet, minute fragments of talc.

WHITE VEINED MARBLE. *Specimen No. 12.*

This is one of the most common marbles, and the painter has frequent occasions to imitate it, but it rarely requires much skill to distinguish between the stone and the imitation. It is generally supposed to be a very easy matter to imitate white veined marble, but it requires a good painter to do it well.

The ground for this marble is a pure white. This being dry, mix white-lead in turpentine and maguip, and with it lay over the work. While the colour is wet, form the veins with a number-two black crayon, and with a hog's-hair softener blend the veins with the ground. This is the manner in which white veined marble is imitated, but simple as it is, requires the exercise of considerable skill.

NAPOLEON. *Specimen No. 13.*

The ground for Napoleon or Boulogne sandstone, is formed of red and umber, with white-lead, to produce the tint required. This being dry, form the character with a feather, and then introduce, in the same manner, a darker colour, so as to produce the necessary variety. The veins which are left unfinished by the feather, are then carried out with a pencil, and this completes the process.

GREEN LAVA. *Specimen No. 14.*

The green lava is a fictitious marble, taken in all probability from some variegated specimen of lava, coloured by copper. It is painted in a manner

very similar to the Napoleon. The ground is a light green, and when this is dry, the character is introduced with a feather, in a green colour, darker than the ground, and slightly stained with umber. The work is afterwards retouched with the feather, in a colour containing more umber, and the veins are carried out with a pencil.

RED PORPHYRY. *Specimen No. 15.*

The ground for that marble which is called red porphyry, is a dark reddish brown, formed of vermilion and black. Then, with a sash-tool, sprinkle the work, with a colour formed of vermilion, and sufficient white-lead to reduce the brilliance of the red, taking care that it shall not run on the work, but present every spot distinctly. This being done, the work must be again sprinkled, and in the same manner, with a still lighter colour.

The Swiss porphyry is considered the most valuable. The ground is black, and it is imitated by the painter in the manner already described, a black and vermilion forming a colour about two shades lighter than the ground being used in sprinkling the work.

The ground for the Swedish porphyry is a greyish stone colour, formed of white, black, and umber. This being dry, lay over the work with a thin maguip, and sprinkle it with a suitable grey colour. This process is repeated with the same colour, containing more black and a little red, but the sprinkling is done more fully, that the colours may run into each other. A white, stained with red, is then used in the same manner.

We have now described the process by which the painter imitates the various woods and marbles commonly introduced in the decoration of houses. The information here given, when combined with the observation at all times necessary to give a complete acquaintance with any art, will enable the reader to judge as to the manner in which the painter has performed his work, and whether he has done all that is necessary to give the required effect. Those who read with an intention to practise the art, may find many hints which will be of value, not only as preventing an erroneous mode of execution, but also as directing them to that which is established by the experience of the most successful workmen.



No. 15

CHAPTER XIII.

THE HISTORY OF HOUSE-PAINTING.

It is probable that the formation of colours engaged the attention of inquisitive men from a very early age in the history of our species. The circumstances which led to their use have been already mentioned, and it is not now our intention to enter that wide field of speculation which is opened to us, when we leave the path of history. Allusion, however, must be made to the state of the arts among the nations of antiquity, and it will therefore be necessary to define, with as much precision as possible, the condition of the science upon which the art of painting chiefly depends.

Some of our readers may doubt the propriety of applying the term "scientific men" to any class of persons among ancient nations, since the knowledge acquired even by the wisest, except upon astronomy, was, in all probability, obtained by accident, rather than by deductions drawn from ascertained laws or principles of nature. But the epithet is, we believe, strictly applicable to all those who study physical effects, in reference to the causes which produce them; for science is but a classification of that knowledge derived from the study of nature, and, how limited soever the knowledge may be, it forms, when combined in a system, a science; and, those who are acquainted with it, or endeavour to add to the facts already ascertained, may be with propriety called scientific men. But the term is at the same time liable to some misconception, and may be supposed to convey the notion that the knowledge of physical causes and effects was classified by the wise men of old, in the same manner as by the philosophers of modern times. Geometry and arithmetic, as pure sciences, and astronomy and optics, as sciences of observation, were thus understood by the ancients, but the sciences which depend almost entirely upon experiment, such as chemistry, were in a most imperfect state, being little more than a combination of a few facts, the connexion of which was but

little understood. No one, however, can doubt that many important chemical facts were known to the Egyptians, and other nations of antiquity, or that the manufacture of colours occupied the attention of the learned.

As it is essential that the difference between the knowledge of the ancients and that of the present day should be thoroughly understood, it may be desirable that we should further attempt to illustrate the state of scientific knowledge at these periods. The Egyptians (and of them we speak as one of the earliest nations possessing scientific knowledge which has descended to our own day,) practised many arts, and among others painting, which depend on certain chemical facts. No one, however, imagines, nor is there the slightest reason to suppose, that they were so acquainted with the elementary principles of bodies, and the laws by which these principles are combined, that by a mere exercise of reason they could foretell the phenomena which would result from presenting one substance to another. Their knowledge was empirical, and was obtained by fortuitous incidents. By the accidental combination of two substances a third was formed, which was discovered to be useful for certain purposes, and was therefore manufactured; but why the decomposition or combination took place, why the newly-formed substance was suited to the purpose for which it was employed, and what were the chances of its continuance in that state, they were unable to discover.

Now, in the present day, we are not left to any rude conjecture, as to the results which will follow the combinations of bodies, or the causes by which the compounds are formed. The composition and qualities of all the most common substances in nature and art have been ascertained, and the chemist can, in most cases, predict, with certainty, the results which will follow when two compound bodies are brought into contact. The principles of the science being thus known, should any discovery be lost, which the art of printing renders almost impossible, it might be easily restored, but in the time of the Egyptians, the loss would be equivalent to the annihilation of so much knowledge. Every discovery was the result of an accident, and if the discoverer should from any motive be induced to keep it for his own personal use, it would remain unknown to the world until another accident revealed it. The manufacture of colours, as employed by the ancients, was acquired in this manner; and it must be allowed that most of them were permanent and well suited to the purposes for which they were employed, but of their composition we are to the present day exceedingly ignorant, and chiefly from the cause already mentioned.

The extension of scientific knowledge, and its diffusion among all classes, render the introduction of bad and futile colours into the market very common. The painter of the present day is indeed liable to great deception, which enhances the importance of chemical knowledge to him, as offering the only means of giving permanence to his works. The Egyptian and other artists of antiquity had no choice of pigments, but such only were presented to them as were found to be durable in nature; in the present day, every manufacturer has an interest in producing that which will enable him to compete with others in trade; and the durability of the colour, for a term of more than a few years, is, in most cases, an object of no moment. The existence of an inferior class of colours is therefore the necessary result of the scientific knowledge we possess; while the permanent character of those used by the ancients may be accounted for from their timidity in the use of a substance not thoroughly tested by time, as they possessed no scientific knowledge which enabled them to determine its qualities by other means.

These facts must be borne in mind whenever we attempt to determine the state of the art of painting among the nations of antiquity, for many difficulties will otherwise present themselves which it will be almost impossible to solve. Nor must it be forgotten, that, in our researches into antiquity, the knowledge possessed in those times has descended to us by but few channels, and these have too often polluted the stream. In meandering through the dry deserts of ages, it has lost not only in freshness but in quantity, so that after a long and laborious research for a river, we discover an unimportant stream.

Our principal object will be to trace the history of house-painting, but we shall find it necessary to give some latitude of meaning to this expression. It would be undesirable, and it is almost impossible, to confine our attention to the manner in which buildings were painted, for it is scarcely less necessary to a full examination of the subject, to ascertain the connexion of painting with all those arts, which, from their domestic or public use in buildings, may be considered to belong to the decorator. The materials which are required for the adequate performance of this portion of our work are easily procured, but some skill will be required in collecting and arranging them, so as to form a combination of facts and deductions which shall have a graceful proportion, and be not less useful than curious.

Great uncertainty exists as to the time when the art of painting was invented, and the nation by whom it was first used. Nor is this to be considered in any way a matter of surprise. In the earliest ages of the

world, whether we consider man in an ignorant, semi-barbarous state, or as an intellectual being, capable of appreciating the beauties of nature, and with an extensive knowledge of things, which we believe to have been his real condition;—in whatever state he may have been, he must have had frequent occasions to represent the forms of things, and the advance from drawing to painting was perfectly natural and obvious. That this was the first means of communicating information to persons at a distance, and of recording events, is certain, from the fact that hieroglyphics were invented before letters. We have an instance of this adoption of drawing in the place of a written language, in the South American Indians. When the Spaniards arrived on their coasts, this remarkable people, emerging from a state of absolute barbarism, were accustomed to the use of a rude hieroglyphical language, and informed their king Montezuma of the advent of the strangers, by a painting of them in their foreign costumes, and their not less remarkable ships.

The fables which have been invented to account for the introduction of drawing and painting, are altogether unworthy of credence. According to one of these accounts, the art commenced with a young female, who drew the profile of her lover upon the wall of her hut; while another traces it to shepherds, who marked upon the earth the form of the shadows thrown by the sun, as a pleasing pastime to relieve the monotony of their indolent employment.

In the first city built by man, of which we have any authentic records, paintings were introduced partly perhaps as a decoration, but chiefly to commemorate the exploits or qualities of those who reigned in it. The walls of Babylon, we are informed, were painted with representations of hunting scenes and combats, and in these, Semiramis was exhibited on horseback, striking a leopard with a dart, and Ninus as wounding a lion. It has been supposed, with some probability, that these figures were painted on the bricks at the time of their manufacture, and afterwards fixed by burning. This notion is supported by a remarkable passage in the writings of Diodorus Siculus.

The Egyptians possessed the art of painting, which they probably derived from the Ethiopians. At the time of the expulsion of the shepherd kings, which was before the birth of Moses, the paintings at Thebes were executed, and these are universally esteemed the most beautiful specimens of Egyptian art. At a subsequent period, when the priests made it entirely subservient to the purposes of the national superstition, and especially when the practice

of the art became hereditary, and the son was compelled to follow the pursuits of the father, it greatly degenerated, and was only employed for the representation of sacred objects. The best specimens of Egyptian painting were therefore on the walls of Thebes, and must have been executed 1,900 years before Christ. The style, however, was never changed. All their works exhibited the same want of knowledge in the application and harmony of colours;—drawing alone was considered, and it must be allowed that in form and expression the Egyptians were not unsuccessful. The sameness of character in their works of art is mentioned by Plato, who says that the pictures in his day differed in no respect from those which were produced in the earliest ages of Egyptian history.

To determine the manner in which painting was introduced in the public and private buildings of the Egyptians is now impossible, but it is by no means improbable that the interior walls and perhaps ceilings of some apartments in the temples were decorated with hieroglyphical or emblematical designs. The same uncertainty prevails as to the application of the art among other eastern nations, and as regards its state it is known to have been even inferior to that of the Egyptians.

There has been some doubt whether the Jews were at all acquainted with the art of painting, but it is scarcely possible to imagine them thus ignorant after a long residence in Egypt, during which period they must have acquainted themselves with all the habits and customs of the nation they served. It is much more probable that the practice was discountenanced from religious motives. In the thirty-first chapter of Exodus there is a relation of the call of Bezaleel to the work of the tabernacle, but painting is not named or alluded to as a part of his employment. "And I have filled him with the spirit of God in wisdom, and in understanding, and in knowledge, and in all manner of workmanship, to devise cunning works, to work in gold, and in silver, and in brass, and in cutting of stones, to set them, and in carving of timber, to work in all manner of workmanship." In the thirty-fifth chapter of the same book there is a further allusion to the works which were to be performed by Bezaleel and Aholiab, and in addition to the subjects already enumerated they were "to work all manner of work of the engraver, and of the cunning workman, and of the embroiderer, in blue, and in purple, in scarlet, and in fine linen, and of the weaver, even of them that do any work, and of those that devise cunning work." The various decorations of the tabernacle are in the following

chapters described with great minuteness, but painting is nowhere mentioned. Moses, however, was acquainted with the art, and even of the existence of pictures among the nations who inhabited Canaan, for in the thirty-third chapter of the book of Numbers he instructs the Israelites concerning them:—“When ye have passed over Jordan into the land of Canaan, then ye shall drive out all the inhabitants of the land from before you, and destroy all their pictures, and destroy all their molten images, and quite pluck down all their high places.” In the writings of Ezekiel, whose prophecy is supposed to have been delivered between the years 595 and 575 before the Christian era, and who was carried captive to Babylon by Nebuchadnezzar, with Jeconiah king of Judah, and three thousand of the principal inhabitants, there is an allusion to the paintings upon walls, but whether they were common among the Jews, or only seen by him among the Babylonians, it is impossible to determine. The most remarkable passage is in the eighth chapter: “So I went in and saw: and behold every form of creeping things, and abominable beasts, and all the idols of the house of Israel, pourtrayed upon the wall round about.” A court in Jerusalem was the locality of the vision, and it is not improbable that the scene brought to the imagination and impressed on the memory of Ezekiel was one which had a real existence in the holy city, or it may have been a representation of the idolatries which he constantly witnessed among the Babylonians, and intended as a symbolical representation of the mental condition of the Jews.

At later periods, the Jews probably adopted many of the customs of the nations who successively obtained power over them, and in the apocryphal book of Maccabees, which was probably written only a few years before the commencement of the Christian era, we have a distinct allusion to the painting of houses, which was probably done after the manner adopted by the Romans. “For as the master builder of a new house must care for the whole building, but he that undertaketh to set it out and paint it, must seek out fit things for the adorning thereof: even so I think it is with us.” It is, however, useless to occupy our time with conjectures as to the condition of an art in ages of which but few relics are preserved, and concerning whose public and domestic habits we have but little information. We shall, therefore, at once descend to those periods of which we have some record, either by the specimens which have been seen in modern times, or are described in the pages of historians who are worthy of our confidence and respect.

Pliny says, that painting was unknown until long after the fall of Troy,

and that drawing was first practised by Ardices of Corinth, and Thelephanes of Sicyon. But this author contradicts himself, for in another place he informs us that the art of painting had arrived at perfection in the time of Romulus, for it was about that period Candaules, king of Lydia, bought of Bularchus a picture, and gave the painter in return its weight in gold. Hence it is evident, he says, "that the origin and beginning of the art was of much higher antiquity, and those painters who used but one colour, lived a long time before, although it is not recorded in what age they flourished." We are, however, in possession of evidence which enables us to refer the beginning of the art to a much earlier age than that named by Pliny, as a period in which painting did not exist. Homer himself alludes to tapestry, the invention of which cannot have preceded the art of drawing, and gives such a description of the designs borne on the shields of his heroes, as to leave no doubt of their being painted. But our authorities carry us to a still higher antiquity. The allusions to the art in the books of Moses, the painted mummy cases of the Egyptians, and the walls of Babylon and Thebes, fix its origin at a period long antecedent to the Grecian era. Troy was taken 1184 years before Christ, but the walls of Thebes were probably painted 1900 years before the commencement of the Christian era, so that painting was known at least 716 years before the taking of Troy, and 993 years before the Homeric poems were written.

If we again turn to Pliny for information, we are informed that before the time of Cleophrastus the Corinthian, the Greek painters, or more properly draughtsmen, drew their figures with coal, but that this artist introduced a colour formed of the powder of a red brick. This style was called by the Greeks *μονοχρώμα*, or single coloured, and upon this they present their claim to be considered the inventors of colour, although it is evident that the Babylonians and Egyptians painted in red and other colours a thousand years before the date of their pretended discovery. The Grecian school of painting may be said to have commenced with Phidias, about 450 B. C., but the names of two men who improved the art, and lived before him, have been preserved, and may be mentioned. Eumarus, an Athenian painter, was one; and he seems to have made some great improvements in the mode of drawing the human figure of both sexes. The other was Cimon of Cleone, who succeeded in throwing his figures into attitudes, and by his knowledge of anatomy successfully introduced the muscles and veins of the human body. His draperies, also, were drawn more correctly, the folds and inequalities of surface being shown.

It was with Phidias, who flourished about 450 B. C., that the Grecian art, properly so called, commenced. This artist, whose statues have never yet been excelled, began his public career as a painter, but was chiefly engaged in sculpture. He lived at a period when Grecian liberty was blooming, and when the confidence inspired by the overthrow of the Persian invaders, was stirring the minds of the wise and virtuous to new developments of excellence. With a mind stored with all the useful knowledge of his age, and an unequalled taste, he commenced his pursuits with enthusiasm, and instantly threw into his work that attribute of genius which has been designated "the ideal." Cicero has finely drawn a character of him, which, applied to any other man, might be called eulogy. "*Phidias cum faceret Jovis formam aut Minervæ, non contemplabatur aliquem æquo similitudinem duceret; sed ipsius in mente insidebat species pulchritudinis eximia quædam, quam intuens in eaque defixus ad illius similitudinem artem et animum dirigebat.*"

When Phidias had raised the arts into high estimation among the Greeks, the candidates for fame became more numerous. We have not forgotten that our present business is to trace the application of the art to the decoration of buildings; nor must the reader imagine that we are deviating from the path by which that information is to be obtained. All the arts of the Greeks were made subservient to the decoration of their public buildings. For that purpose their artists laboured, and the state expended its resources; so that the biography of every artist is in fact, a contribution to the history of the decorative art in the state to which he belonged. It is for this reason that we shall attempt to give a brief account of the lives of the most celebrated Greek artists and their works, before we enter upon a description of the several styles of painting.

Panæus, the brother of Phidias, was a painter of merit, and his works were highly esteemed by his contemporaries. The battle of Marathon was one of his principal paintings, and must have been a work of importance, for he introduced in it the figures of some of the principal combatants,—Miltiades, Callimachus, and Cynegyrus, among the Greeks; Datis and Artaphernes among the Persians. He also painted the wall which surrounded the statue of Jupiter Olympius, at Elis. The subjects were, Atlas sustaining heaven and earth, relieved by Hercules; figures of Theseus and Pirithous; emblematical representations of Greece and Salamis; Ajax reproached by Cassandra; Hercules and the Nemæan Lion; Hippodamia, daughter of Œnomaus, and her mother; Prometheus chained, with Hercules coming to

his assistance; Prometheus delivered by Hercules; Achilles supporting the dying Penthesilea; and the two Hesperides bearing golden apples.

Polygnotus flourished about thirty years after Panæus, that is, 420 B. C. He was the son of Aglaophon, a painter, and was born at Thasos, an island in the Ægean sea. He is said to have made great improvements in his art, and was very successful in his attempts to give life and expression to the human countenance, which he did by opening the mouth, and displaying the passions. His draperies, also, were more light and flowing than those of his predecessors, which enabled him to give a better representation of the female form. Polygnotus was engaged in decorating the *Ποικίλη*, at Athens, a gallery so called from the variety of its embellishments, and the hall at Delphi. His subjects were scenes connected with the Trojan war. For this work he refused to accept any remuneration, but he received that which was probably to him the highest reward, the thanks of the Amphictyonic council on behalf of the commonwealth; and a decree was at the same time passed, that he should be supported at the public expense, wherever he might travel. One of his pictures was preserved in the gallery of Pompey at Rome. It represented a man on a scaling ladder, with a target in his hand, and was so painted, that no one could determine whether he was ascending or descending.

Mycon was the contemporary of Polygnotus, and was engaged to paint a part of the same building upon which, as we have already stated, Polygnotus was employed. He is chiefly known to us as having introduced some new colours, and made improvements in the materials of his art. He made a new black pigment from some part of the vine, and introduced Attic ochre into his pictures.

Apollodorus flourished 410 B. C. He is described by Pliny as the first artist who, by the intrinsic excellence of his pictures was able to fix the admiration of those who beheld his works. "Neque ante eum tabula ullius ostenditur quæ teneat oculos." His most celebrated pictures, or at least those to which the highest character is given by Pliny, were a priest at his devotions, and Ajax struck with fire from heaven. According to Plutarch, he was called the shade painter by his contemporaries, from the circumstance of his being the first to observe that the colours of bodies should be retained, even under a depth of shade, but Quintilian gives this honour to Parrhasius. He was the first painter, says a writer in the *Encyclopædia Metropolitana*, "who carried the disposition of light and shade, and chiaro oscuro, to any degree of perfection." He possessed, no doubt, a genius for the art which he had

embraced, but his success and reputation were in all probability still more the result of the care with which he finished his pictures, and his practice of destroying all those of his works which fell short of that which he intended.

Zeuxis, who has been so extolled by the ancients that we may consider him one of the most distinguished of the Grecian painters, was born in Heraclea, but whether it was a city of that name in Macedon, or the one near Cretona in Italy, cannot now be ascertained. He studied under either Demophilus or Neseas, but the talents of these artists we have no means of determining. As a man, his character is unworthy of our esteem, for although he seems to have disregarded wealth, when he had obtained a competence, every act of his life was dictated by a most absurd vanity, which knew no bound. It is recorded of him, that when in the zenith of his fame, honoured and applauded through Greece as the greatest master of his art, he appeared at the Olympic games in a mantle, on which his name was embroidered in gold. Even the liberality with which he bestowed his works upon various states was the offspring of his pride, for when he refused payment, it was with the assertion that no money was an adequate remuneration for his pictures. We have, however, less to do with his character as a man, than his qualities as a painter.

"The doors that Apollodorus had opened," says Pliny, "Zeuxis boldly marched through, about the ninety-fifth olympiad, daring every thing the pencil could do, and carrying it to the greatest glory." Apollodorus himself, who was mortified at being outdone by a youthful rival, pays a high tribute to his genius, when he says of him that he moulded to his own use all previous inventions, and stole the graces of the best masters. Archelaus, the king of Macedon, became his patron and friend, and engaged him to paint several pictures for his palace. Socrates said, that the monarch by expending large sums of money on his house, had induced men from all parts of the world to come and see his palace, but none thought of visiting its owner except those who were allured by his presents, and these were not among the most virtuous of men.

The greatest works of this artist seem to have been two female figures, one of Helen, and another of Penelope. The circumstances under which the former was painted have been recorded by Cicero. Zeuxis was invited by the inhabitants of Cretona to paint a number of pictures for the temple of Juno, and the price which was to be given for them, and the other conditions

necessary between the parties, were arranged. But, upon his arrival in the city, he informed the inhabitants that he did not intend to paint more than one picture, a figure of Helen, to which new stipulation they seem to have willingly consented, from the peculiar excellence of his female figures. From five of the most beautiful maidens in the city he painted and produced a picture which seems to have been the admiration and envy of all Greece. The same circumstances are mentioned by Pliny, but he says that it was for the people of Agrigentum that the painting was undertaken. In the time of Pliny, there was a Helen by this artist at Rome, under which were written some verses from Homer, (Il. III. v. 156,) which Pope has translated or rather paraphrased :

“ They cried, No wonder such celestial charms
For nine long years have set the world in arms.
What winning graces ! what majestic mien !
She moves a goddess, and she looks a queen !”

The last verse, if correctly translated, would read, “ For she resembles the immortal gods.” His Penelope must have been a fine picture, to have merited the encomium which has been passed upon it, as possessing “ a modesty which was more impressive than a lesson on morality.” The subjects of his other paintings were Marsyas bound to a tree, preserved in Rome, his Alcmena, representing the infant Hercules strangling the serpents in his cradle ; the Centaurs, which Lucian has well described ; and a wrestler, beneath which he in the distension of his vanity inscribed a verse, that it was easier to envy than to imitate. But his greatest work was Jupiter seated on his throne, and receiving the adoration of the gods.

Zeuxis lived to a great age, and is said to have died of laughter, at a picture of an old woman, which he had himself painted.

Parrhasius, who was born at Ephesus, and received the elements of his art from Evenor, his father, lived about 400 B. C., and was the contemporary and rival of Zeuxis. It is stated that these two celebrated artists had on one occasion a trial of skill. Zeuxis had painted a bunch of grapes, which was so good an imitation of the fruit, that the birds came and pecked at it. Certain of success, he requested his rival to withdraw the curtain which concealed his work, when, to his astonishment, he found that the supposed curtain was a painting by Parrhasius. His character, as an artist, is well described by a writer in the *Encyclopædia Metropolitana*. “ He is

said, by Pliny, to have been the first who observed the rules of accurate symmetry, in portraying the human figure, which it seems to have been the practice even of his most celebrated contemporary to disregard. His peculiar excellences consisted in his designs and his outlines, in the first sketching and exterior lines of his pictures, which Pliny regards as the most difficult part of the art. He excelled, also, in the expression of character, respecting which Xenophon has preserved a dialogue between him and Socrates, which the latter turns to moral uses. He is said to have first delicately painted the hair, and to have disposed it in tresses, so as to add to the beauty, or to assist in the general expression of his figures. He painted, also, most inimitably, the lips and mouth, touching them with peculiar sweetness and finishing them with singular grace. But, in general, he was defective in the filling up, in the shading and colouring of the masterly outlines which he drew. His sketches and outlines, many of which he left without filling up, both on tablets and parchment, became in after times the studies of youthful painters."

Descriptions have been left us of many of the finest paintings produced by Parrhasius, some of the subjects of which may be mentioned. His greatest work was an allegorical painting of the genius of the Athenians, in which he endeavoured to "embody all the wayward and contradictory passions and feelings; the stupendous greatness, and the singular weaknesses; the admirable tastes, and the contemptible jealousies, of that most strange yet most interesting people." He is said to have been peculiarly happy in his representations of youth and childhood, which might indeed be conjectured from the number of his subjects in which they were introduced; a nurse with an infant in her arms, and a priest attended by a child with a censer, were probably not the least beautiful of his paintings. Beside these, many others have been recorded by the ancient historians;—a man in armour running, to which figure he gave an air of weariness, as if oppressed by the load which covered him—a man in armour undressing, exhibiting a feeling of exhaustion—two boys, with innocence and a freedom from care, strongly marked upon their countenances—a Bacchus with Venus standing over him—a group of figures representing Æneas, Castor, and Pollux; and another of Telephus, Achilles, Agamemnon, and Ulysses. A third group, in which the figures of Meleager, Hercules, and Perseus, were introduced, was preserved at Rhodes, with the most superstitious reverence, and a degree of sanctity was attributed to it, under the supposition that the tablet on which it was painted had been three times struck with lightning, and the colours

remained uninjured. But, of all his pictures, none were perhaps more worthy of his pencil than the figure of Theseus, by which he obtained his freedom of the city of Athens, not even excepting his Archigallus, which Tiberius kept in his bed-chamber, and valued at the price of sixty thousand sesterces.

It is impossible to consider the subjects upon which the pencil of Parrhasius was employed, and the character given to his works by the ancients, without perceiving that he must have been an artist of genius; and from the choice of subjects in which the innocence and simplicity of childhood formed a principal feature, it would be almost impossible to believe that he could have been a man of reprobate and cruel mind. Yet Pliny informs us, that in his moments of leisure, he relaxed his mind by a representation of subjects of immoral tendency. It has also been asserted, that, in order to depict with a more vivid reality the sufferings of Prometheus, he caused an Olynthian captive to be put to death by torture. This tale, however, is not corroborated either by the concurrent testimony of authors, or by the character of his works. He was a man too much under the government of superstition and pride, which, together, drove him to the very verge of that precipice which separates the highest efforts of mind from frightful insanity. That he was vain, is evident, from his having attached a variety of ennobling epithets to his name, and from his having claimed a descent from Apollo. That he was afflicted with monomania appears from his assertion, that Hercules had appeared to him in visions, to enable him to take a correct portrait. The latter anecdote reminds us of the peculiarities of Blake, our late esteemed and talented countryman.

Allusion has already been made to a competition between Parrhasius and Zeuxis, in which the former obtained the advantage. But there was a more equal trial of skill, which he afterwards accepted with Timanthes. A subject, in this instance, was chosen—it was the indignation of Ajax on the adjudication of the arms of Achilles to Ulysses—and the painting by Timanthes was greatly preferred. To a man who possessed so much self-esteem, and traced his origin to a god, this must have been a most vexatious and depreciating failure, but “he consoled himself by affecting to lament the fate of Ajax, a second time overcome by his inferior.”

Timanthes was an artist of whom we desire to have more information, for he appears to have not only surpassed all his contemporaries in depth of feeling, and the ingenuity with which he treated his subjects, but also in his appeal to the fancy of those who viewed his designs. In his works, says an eminent historian, as in the descriptions of Homer and Milton, more

was understood than expressed. The sacrifice of Iphigenia was probably his most successful production. In his design, he represented the virgin, robed in innocence and calm resignation, standing before the altar, surrounded by her relatives and friends, in whose countenances he exhibited all the gradations of grief. This passion was carried to its height, consistent with a manly and noble deportment, in the countenance of Menelaus her uncle; but the face of Agamemnon, still more deeply agitated by the unhappy fate of his daughter, was hidden in the drapery of his robe. Another instance is given us of the ingenuity with which he managed his subjects. Having drawn a Cyclops to a small size, some contrivance was necessary to give the figure its gigantic and monstrous magnitude, and for this purpose he introduced satyrs measuring his thumb with rods. The scanty information concerning this artist to be collected in the works of the ancients, only prompts our desire for further acquaintance with him, which, alas, there is no hope of ever attaining. There was, perhaps, no picture of antiquity more worthy of preservation, had Time studied the merits of artists, than the picture of a prince by Timanthes, once preserved in the temple of Peace at Rome, which was so perfect in proportion, and so majestic in its air, that it was a form which the noblest of the gods might have been proud to wear.

Of Eupompus less is known than of Timanthes: with him, however, commenced the Sicyonian school. Before the time of this artist, there were but two distinct styles, the Grecian or Helladian, and the Asiatic; but in consequence of his works, the former was divided into the Sicyonian and Attic, the works produced by the natives of all the towns of Asia being known under the general designation of Ionian. Pamphilus, the master of Apelles, was his pupil. The paintings exhibited by Ptolemy Philadelphus, were almost entirely of the Sicyonian school, and it has been supposed that it survived all others. The most celebrated painting by Eupompus, was a conqueror in the games, holding the branch of a date tree.

Pamphilus was a native of Amphipolis, a city on the borders of Macedonia and Thrace. He was a man of philosophic mind, of great literary attainments, and profoundly acquainted with the mathematics of his day. He established a school at Sicyon, but would take no pupil for a less sum than a talent of silver, for which he engaged to continue his instructions ten years. During his residence in Sicyon, he raised the arts into the highest repute, and ultimately succeeded in having a law passed for the instruction of the citizens in the arts of design, during their youth. The same decree

confined the arts to the free inhabitants of the state; they were considered too ennobling for slaves, and were therefore forbidden to them. The same laws were afterwards passed in nearly all the Grecian states.

Pamphilus painted several pictures, which were very highly esteemed by the Greeks. The subjects of some of these have been recorded, and we may mention the Heraclidæ with olive branches, soliciting the assistance of the Athenians—the battle before Phlius, and the victory of the Athenians—a family picture, and the vessel of Ulysses on the sea.

From what we have here said, it will appear, that about 400 B. C. there were, in Greece, a number of extraordinary painters, all of them perhaps contemporaries, yet in the relations to each other of masters and pupils. The age in which Apollodorus lived, was also distinguished by the works of Zeuxis and Timanthes, and Eupompus and Pamphilus of Sicily; to which may be added those of Euphranor of Corinth, and Nicias of Athens, as well as of others, whose names only have descended to our day.

Euphranor, the Corinthian, was celebrated as a sculptor, as well as a painter. He wrote a work on symmetry and colours. The subjects of his most celebrated paintings were the twelve gods, and Theseus. Of the latter, he may be supposed to have entertained an opinion extremely flattering to his vanity, if we may believe the assertion, that he boasted his Theseus had fed on flesh, but that of Parrhasius on roses.

Nicias, the Athenian, excelled in colouring and in his female figures. His Andromeda, Io, and Calypso, were considered master-pieces of art, but his design of the Necromantia of Homer was his chief work. For the latter picture, Attalus, king of Pergamos, offered a sum equal to twelve thousand pounds, but the artist rejected the money, and presented it to his native city.

In this brief account of some of the most celebrated Greek artists and their works, we have paid but little attention to Pliny's pretended epochs of art. "The Greek historians, from whom he copied this part of his work," says Dr. Gillies, whose remarks on this subject are worthy the consideration of all who record the progress of the arts, "found it convenient at every pause in their narrative to give some account of men who had distinguished themselves in the arts and sciences, of whom they had no opportunity to make mention in recording public transactions, and relating wars and negotiations. The æra of every peace furnished a proper resting-place to the historian, from which he looked back and collected the names worthy to be

handed down to posterity. Every such æra, therefore, Pliny, and after him Winkelmann, have considered an epoch of art; not reflecting that arts do not suddenly arise and flourish, and when they once flourish do not suddenly decay, since the mind long retains the impulse which it has received; and the active powers of man, when once directed to their proper objects, are not easily lulled to repose."

Before the art of painting lost its vigour in Greece, another race of artists arose, among whom Apelles, Aristides, Nichomachus, and Protogenes, were the most celebrated. Apelles, 'the god of high finish and grace,' as he has been called, was born at Cos, and was universally considered the greatest of all the Greek painters. Pliny, speaking of him, says, he enriched the art more than all his predecessors. His most remarkable power was that of giving to his pictures an inimitable grace. He was the contemporary of Protogenes, and the rival artists may be supposed to have had some degree of the jealousy so common among painters. But Apelles was of a gentle mind, and graceful in his manners, and though conscious of his superiority in some particulars, was always willing to bestow praise, when it was due, upon others: an instance of this is recorded on the occasion of his visit to Protogenes. Being anxious to form an acquaintance with that artist, he sailed for Rhodes, where Protogenes resided. When he called, the painter was from home, but seeing a large table, set in a frame, ready for a picture, he drew upon it, in colour, a fine line, saying to the woman who kept the house, "Tell thy master that he who made this line inquired after him." Upon seeing the line, Protogenes knew that none other than Apelles could draw with so much beauty, but having drawn upon the same tablet another and still finer line, in a different colour, ordered the woman to give it to his visitor, when he again called. Apelles blushed to see himself thus outdone, but with another colour drew a third line, still more graceful and true to nature, so as to leave no room for a fourth. Protogenes confessed the superiority of Apelles, and with haste sought to give him a welcome and friendly entertainment. This table was long preserved, but was at last consumed in the fire which destroyed the palace of the Cæsars, on the Palatine hill. It is not our object to write a minute account of this wonderful artist, or it would be easy to fill many pages with the interesting tales which have been left concerning him, by Pliny and other writers. But we must not omit the fact, that although richly endowed by nature, he well knew that practice alone could give him success in his art, and so assiduous was he,

that his constant daily application originated the proverb, "*nulla dies sine linea*,"—not a day without a line.

Apelles painted some of the most valued works of the Greeks. His Venus Anadyomene was his most celebrated production, but it was painted on wood; and in the time of Augustus was found to have been destroyed by insects. Among his other works we may mention a few subjects:—Venus rising out of the sea—Alexander with a thunderbolt—Calumny—the priests of Diana at Ephesus—Clytus arming for battle—and the procession of Megabyzus.

After the age of Apelles and his contemporaries the art of painting greatly declined; and the Grecian school may be said to have died with these artists. Of their lives and works we shall not speak in this place, but proceed to make that use of the information collected in the few preceding pages for which it has been introduced. We have traced the progress of painting among the Greeks, by a brief biography of some of their most celebrated artists; we have described the subjects upon which their pencils were employed; and we have stated generally, that all the greatest works were intended for the decoration of public buildings, or the residences of the illustrious and wealthy; but it still remains to explain the manner in which these works were executed, and how they were introduced for the purpose of decoration.

The pictures of the Greeks were painted either on tabular pieces of some hard substance, such as larch, fir, and box-wood; or upon the walls and ceilings of buildings; and thus the art was divided into tabular and mural painting. As the Greek artists were unacquainted with the use of oil as a medium of colour, their pictures necessarily wanted that permanence which its introduction has given to the productions of the modern brush, and they have consequently been entirely lost; nor would they have been sufficiently enduring to have encouraged the artist to paint, or to excite the taste of the nation which so amply awarded their authors, had the climate been less favourable.

There were two modes of painting—one was encaustic, or painting with a colour prepared with wax; and the other was distemper, or a colour prepared with glue. In all mural painting, whether encaustic or distemper, brushes were used; but in encaustic on wood a metal point, called a stylus, was employed. The tables, or tabular blocks, to be painted, seem to have been covered with wax, and upon this yielding surface the design was drawn with

the stylus, in a manner similar to our etching. "At a sale of antiquities in London," says a writer in the *Encyclopædia Britannica*, in some excellent remarks upon Grecian art, "there was a regular Greek tablet, with a wax ground, and a stylus attached to it, as boys hang slate-pencils to their slates, and a sentence of Greek actually half cut. The word *γραφω* being used for painting, design, or writing, makes the instrument the same in either case. The tablet was like a slate; the middle had been planed smooth, and the frame was left round it. The progress of the Greeks is very interesting, and shows how the mind gradually advances in the imitation of reality, and rests impatiently on mere outline as a representation of nature. After a certain time, the early artists, when they had drawn an outline, ventured to colour it inside with black. This mode of imitation was called *σκιαγραφια*, and the painting *σκιαγραμματα*, or skiagrams, from *σκια*, shade, and *γραφω*, to draw. Our black profiles and whole figures, seen in shop-windows, are the skiagrams of the ancient Greeks. This was held as a great step, and the painter who could fill up a face or a figure with black was hailed as a man eminent in art. After a little time came the genius with more extended views, who invented the *μονογραμμα*, or monogram, from *μονος*, only, and *γραφω*, to draw; that is, to define by line only, without a shadow. Next came the man who had nerve to try a positive colour. Pliny has preserved his name—Cleophantus of Corinth. He ground up a red brick, and therefore the Greeks claimed the invention of colour, although the Chaldeans had painted men red on the walls of Babylon, and so had the Egyptians on their tombs, nearly one thousand years before them. This discovery was called *μονοχρωμα*, or monochrom, single-coloured, from *μονος*, alone, and *χρωμα*, colour; and this was their first attempt at imitating flesh. Next came the white ground, (the gesso of the Italians, and lime and plaster of the Egyptians,) covered with wax. From one colour, naturally enough, came the others; for if brick produced red, earths, burned or natural, would produce other colours; and polychrom, from *πολυς*, many, and *χρωμα*, colour, was formed." In this gradual manner the tablet painting of the Greeks arose; from a simple etching upon a layer of wax, to the most perfect representation of subjects, real or ideal, in all the harmony of colours. This description, however, has only reference to the mode of preparing the tablet, and the successive improvements made in that style of painting. We have yet to consider the manner of preparing the colours; but it will first be necessary to make a few remarks upon painting on walls.

It has been asserted by many writers that the Greeks never painted in fresco; and it may be reasonably doubted whether this style was ever adopted, except in the introduction of some architectural ornaments. In fresco the colours are applied to the wet plaster; and by sinking into the material, they, in fact, become a part of it. But all colours cannot be thus applied, being destroyed by contact with the lime; and as these colours were more frequently used than any others by the ancients, it is probable that the Greeks commonly painted in stucco, that is, upon the dry plaster.

It has been doubted whether the Greeks were acquainted with the use of the brush; but, independent of the consideration that it would have been impossible for them to have painted in distemper without this instrument, we might be warranted in forming an opposite conclusion, from its use among other nations, and the necessity for it in many of the most common purposes of life. The ark, in which a remnant of the human race was preserved at the time of the great universal catastrophe, was pitched inside and out; and how this could have been done without brushes it is impossible to imagine. The Egyptians, we know, painted with them; and they were not less necessary to the Greeks, as they had ships which needed protection from the destroying influence of an alternate exposure to water and the atmosphere. It is true that Pliny speaks of the mode of boiling the wax, and painting the ships with it, which, he says, is a lasting mode, so that neither the sea, wind, nor sun can destroy the wood thus protected, as being the method last discovered: but if we admit his statement, as to the date of the discovery, it cannot be denied, that, when it became the customary process, brushes must have been required.

This brings us to the last inquiry, the process of painting in encaustic; or, in other words, the application of wax in colours, by the Greek artists; and this is the most difficult and most disputed subject. Paintings upon walls were, without doubt, commonly done in distemper, and afterwards varnished: but as the encaustic mode was sometimes adopted, we have instances of encaustic mural paintings in the records of the works of many Greek artists, but we may especially mention the walls of Thespiæ, which were painted by Polygnotus, and which Pausias was employed to repair; but the latter artist failed, being unaccustomed to the use of the brush; from which it would appear, that Polygnotus painted his designs in encaustic with a brush; or, in other words, that the wax was mixed with his colours. If this view can be entertained, which we believe to be a correct one, the

Greeks, though ignorant of oil as a medium of colour, were in possession of that which was the best substitute; and pictures may have been produced not unworthy of the encomiums which their poets, historians, and philosophers, passed upon them—not elegant outlines daubed with colours in mosaic, as we are apt to imagine them—but works of art, which Phidias might admire, and which were worthy of the inimitable taste of Apelles, a name still esteemed as the personification of grace and beauty.

In those cases where the colours were known to be fugacious, varnish was applied, which consisted of warm punic wax, tempered with oil. When the varnish was dry, it was heated by the fire of the chafing dish, which was indispensable to a Greek artist, until it sweated, and was then rubbed with wax tapers, and polished with white napkins. This method was called *καυσίς*, and to all encaustic pictures the term *ενεκαυσεν*, *burnt in*, was applied.

There are four methods of encaustic painting, as stated by an author whom we have already quoted. 1. The colours might be mixed with wax, and thinned with a liquid, when required for use. 2. Wax of different colours might be placed on ivory, and united by working them together with sufficient heat. 3. The wax might be boiled and used hot with the colours. 4. The wax might be employed as a varnish in the mode already described.

From these few general remarks, it may be doubted whether the moderns have not much depreciated the art of painting, as it existed among the Greeks. Is it not unreasonable to suppose that a people who possessed the exquisite works of Phidias, the noblest sculptures ever produced by the hand of man, works which the greatest artists of all ages have viewed with a feeling allied to reverence, and with a despair of imitating, should be satisfied with such unmeaning daubs as we seem to attribute to them? and is it not still more improbable that Phidias himself, and Apelles, who possessed a genius not inferior, should be content with such an unsatisfactory if not despicable art? The Greek artists were applauded by Socrates as the wisest of men. Æsop spent much of his time in their painting rooms, and they were the companions of the greatest intellects of their age. Their works were associated with the sculptures we so much admire, which could not have been permitted had they not been executed in a better style than is commonly imagined to have distinguished them. It is, perhaps, saying more than will be admitted by many writers of the present day, but justified by the well-known taste of the Greeks, that the temple in which the Elgin marbles were the inferior architectural ornaments, and in which the Minerva

of Phidias was erected, was no doubt painted in a style in no respect inferior to the general construction of the building, and the unequalled marble it contained.

But we must now turn to the productions of another people, and it seems necessary that we should make a few remarks upon the state of painting among the Etruscans, before we direct the attention of the reader to the decorations of the Romans.

It is universally admitted, that the arts rose to a higher state among this people than the surrounding nations, and that they were the first to introduce them into Italy; but who the Etruscans were, and by what means they acquired their knowledge, is still a matter of doubt and dispute among scholars. They inhabited a district or province of Italy, which was separated on the north from Liguria, by the river Macra; on the east, from Umbria, by the river Tiber; on the west, it was bounded by the Tuscan Sea; and on the side of Cisalpine Gaul by the Apennines. This people were called by the Greeks Tyrrhenians, or Tyrsenians, but their native appellation was Rasena. "The ancient Roman terms," says Niebuhr, "were Etruria for the country and Tusci for the people; that of Etruscus did not come into use till after Cato's time, though subsequently it became the more usual in the language of books. But the old name must have continued prevalent in the mouth of the people, for under the later emperors the name Tuscia, which had never before been used in writing, was applied to the country, and in the middle ages passed into Toscana, whence Toscani."

When all the other inhabitants of Europe were sunk in barbarism, this remarkable people were possessed of a high state of civilization, and practised, with a success which is the wonder of modern times, the arts of design. From them the Romans in all probability derived their laws, customs, religious fables, and learning.

According to Herodotus, the Etruscans derived their origin from a colony of Lydians, who, driven from their native country by famine, wandered long to find a suitable home, and at last settled in a part of Italy, and gave themselves the name of Tyrrhenians, from Tyrrhenus the conductor of their emigration. Other ancient writers agree with Herodotus, from whom their information was in all probability derived, in tracing the Etruscans to a colony of Lydians. The moderns, however, have, from various considerations, been dissatisfied with the account given by the father of Greek history, and have endeavoured to establish theories which appear to them to account more satisfactorily for the facts which have been collected. To trace all these

opinions, many of which are wild and unfounded, would not be consistent with the character of this work, yet it is not desirable that we should pass the subject over without some remarks, although they must necessarily be brief and general.

Dempster, a writer who did much to place the Etruscan antiquities before us in a right light for careful examination, supposes that previous to the immigration of the Lydians, there was a native and aboriginal race occupying Etruria, and that the Lydians, as well as other colonies from Thessaly and Arcadia, united with the aboriginal inhabitants, forming a new and independent nation. With this opinion, many other authors have coincided, but attribute the advance of the arts among them to an early connexion with the Phenicians, or the Egyptians, while others maintain that they were of Egyptian descent.

Müller, dissatisfied with all these opinions, traces their knowledge and civilization entirely to an early intercourse with the Greeks, independent of whom, according to some scholars, there was nothing great, nothing good. "It remains," he says, "that we regard the Tuscan nation as an original peculiar people of Italy; their language is widely different from the Greeks, the names of their gods are not those which we find among the earliest Greeks, whom we call Pelasgi, and which passed from them to the Hellenes: there is much too in the doctrine of their priests, entirely foreign to the Greek theology. But it appears to have been the fate of this nation, which never displayed any independent civilization, but only adopted that of the Greeks, to have been indebted for its first impulse towards improvement to a Greek, or at least half Greek tribe. The Tuscans themselves, in their native legends, referred their polity and civilization to the maritime town of Tarquinii, and the hero Tarchon, both probably only variations of the Tyrrheni. Here it was that the much-dreaded Pelasgians of Lydia landed and settled, bringing with them the arts which they had acquired at home or on their way. For the first time the barbarous land saw men, covered with brass, array themselves for battle at the sound of the trumpet; here first they heard the loud sound of the Lydo-Phrygian flute, accompanying the sacrifice, and perhaps witnessed, for the first time, the rapid course of the fifty-oared ship. As the legend in its propagation from mouth to mouth swells beyond all bounds, the whole glory of the Tuscan name, even that which did not belong to the colonists, attached itself to the Tarchon, the disciple of the Tages, as the author of a new and better era in the history

of Etruria. The neighbouring Umbrians and Latins named the nation, which from this time began to increase and diffuse itself, not from the primitive inhabitants but from these new settlers. For since, in the Eugubine tables, Tursce occurs along with Tuscom and Tuscer, it is impossible not to conclude that from the root *Tur* have been formed Tursicus, Turscus, Tuscus, as from the root *Op*, Opseus and Oseus, so that *τυρρῆνοι* or *τυρσηνοι* and *Tusci* are only the Asiatic and Italian forms of one and the same name."

Niebuhr, the best authority on classical history of modern, and perhaps of any other times, considers the opinions which have been entertained concerning the origin of the Etruscans to be erroneous; but as we cannot enter more fully into a consideration of this perplexing but interesting question, we at once refer the reader to his *History of Rome*, for more ample information; and proceed to make a few remarks on the state of the arts among them, more particularly that of painting.

The Etruscans, to whom the Romans were indebted for their future greatness, so well improved their natural talents for the arts, during a long period of peace, that their works are even in the present day admired as the productions of great skill and knowledge. They appear to have excelled in modelling, and their pottery was superior to that of any other ancient nation. In architecture and painting, they were also eminently successful. There are many specimens of Etruscan workmanship in this country, and all our readers have probably been struck, when examining them, with the remarkable delicacy and beauty of outline which distinguishes the figures upon their vases and other productions. They are, for the most part, red figures on a black ground, but we have no room from this circumstance to doubt of their possessing an adequate knowledge of colours. The walls of the houses and tombs were decorated with paintings, which were executed with a skill and taste, nothing inferior to the works of the Romans, at a later period. The colours are bright and striking, and the designs are far superior to what might have been anticipated from any nation of so great antiquity. To those who may be interested in the study of Etrurian history and antiquities, Mrs. Hamilton Gray's *Tour to the Sepulchres of Etruria* will be a valuable acquisition, and we cannot perhaps better illustrate the style of decoration adopted by the inhabitants than by quoting her description of the painting in the Grotto del Triclinio, in the ruined city of Tarquinia:—

"In the picture in the middle wall are three couches, each containing a

man and a woman, and in front of two of these are tables covered with vases, while in front of the other is a large vessel, out of which wine is poured into smaller vessels, to be handed round to the guests. There is a sort of buffet at the side filled with tazze and vessels of various forms. The richness and beauty of the party-coloured coverings of the tables and of the couches are remarkable; as well as the splendid festal dresses of the guests, and their crowns of ivy and olive. An attendant, richly dressed, plays on the flute, while a naked boy serves the tables, having in one hand a small vase, and in the other an instrument, with which he is studiously sprinkling the meats with salt, or some other condiment. The guests are turning towards each other in various attitudes and with lively gestures, and seem much more occupied with the pleasures of society than with those of the table. But the feast is already begun, for one of the ladies is in the act of eating an egg, while the gentleman next her is emptying a tazza to her health. The ladies are adorned with rich necklaces and bracelets. Ointments, and perfumes also, so essential to the luxurious habits of the ancients, are not wanting to this banquet. The clatter of the dishes and the smell of the meats, have attracted to the feast a tame cat, a partridge, and a cock, which are assiduously picking up the crumbs of good things. Above the couches, hang crowns or chaplets, with which the guests at the end of the entertainment used to adorn their heads, necks, and arms, when they took their luxurious siesta, or further indulged in the pleasures of the goblet. The feast being concluded, the dance commences. The ballet consists of eight persons, and the musicians are two, a player on the lyre and one on the double flute, but even they take a part in the dance. The prima danzatrice moves her hands as if she had castanets, while the last holds a wreath of ivy, with which most of them are crowned. They are all handsomely buskined, and accompany the dance with a lively movement of the head and arms, which reminded me of the tarantula. The dresses of these dancers are of the most splendid material, embroidered with minute stars, and adorned with party-coloured garnitures: their necks are ornamented with costly collars, their ears with pendants, and their arms with bracelets. The youths are divided from the dancing girls by olive and myrtle trees, covered with chaplets, in the branches of which are perched various birds; while hares, wolves, deer, and other animals, are jumping up to the stems, or gambolling below in evident enjoyment of the feast. The vase, placed on the ground, is filled with wine, to be drank by the dancers in honour of Bacchus."

This picture is extremely interesting, from the insight it gives us into the manners and habits of the Etruscans, as well as their knowledge of the arts, and painting in particular. In other pictures, discovered by modern travellers, we may read the domestic history of this remarkable people, while the style of execution, and the character of the designs, point out in every case the relative age.

It is a singular fact, that almost the only records of the paintings of ancient nations, preserved for modern times, with the exception of those in the buried cities of Pompeii and Herculaneum, which may be said to have been entombed by a great effort of nature, are those in the sepulchres. In the tombs of the people of Egypt we find the best records of their skill, and the same is true in Etruria, but the latter bring more vividly before us the manners of the inhabitants. Nor is it of their habits only that we gain information from the study of these pictures, their superstitions and religious belief are recorded in the same manner. On a frieze, in the Grotto del Cardinale, is painted a procession of souls going to judgment, from which it is evident that the Etruscans believed in a future state, and in the doctrine of rewards and punishments. One group in particular is mentioned by Mrs. Gray. It represented the soul of a person whose character was doubtful. He is drawn to the judgment seat in a car, by two winged genii, one of which is an evil and the other a good spirit, both of whom are contending for the possession. The spirits are distinguished by a cothurnus, or buskin, of the form sacred among the Etruscans to immaterial existence, and by their wings. The evil genii are painted black. In the tombs of Tuscania a sarcophagus was found containing the skeleton and armour of one of the chiefs of the family of Velthuri. Among a variety of other articles, found in the tomb, there was a pair of loaded dice; and, on both sides of the sarcophagus, there was a representation of a human sacrifice, which, we fear, was but too common among all the nations of antiquity.

The interest which is felt by all those who are engaged in researches among the tombs of Etruria is constantly excited by new discoveries, which give a more perfect view of the character, manners, and civilization, of the Etruscans. Not long since Signor Avolta discovered in a Tarquinian tomb the body of an ancient Etrurian king, clothed in armour, and crowned with gold, having a shield, arrow, and spear, by his side. He gazed on the body for a period of five minutes, when it crumbled to dust, leaving only the metallic substances entire.

The Egyptian character of the paintings upon the Tarquinian tombs, is particularly mentioned by travellers. "It is singular," says Mrs. Gray, "that the men represented in these tombs are all coloured red, exactly as in the Egyptian paintings in the tombs of the Theban kings. Their eyes are very long, their hair bushy and black, their limbs lank and slender, and the facial line, instead of running, like that of the Greeks, nearly perpendicular, projects remarkably, so that in the outline of their face they bear a strong resemblance to the negro or Ethiopian figures of Egyptian paintings. They wear, round their ancles, rings as ornaments, and armlets on their arms. Shawls, of oriental patterns, are also worn by both male and female. Many of those engaged in the sports have only a wrapper of linen round their loins. Some have boots of green leather, reaching behind to the calf of the leg."

The Etrurians possessed, no doubt, many valuable records of their own history, but these have been unfortunately lost, and those of the ancient historians who had an opportunity of availing themselves of these treasures, neglected to do so. Of their language we are in the present day almost entirely ignorant, for no more is known concerning it than its alphabet, and that it was written, like the eastern languages, from right to left. It has been asserted, that there was a great analogy between it and the Hebrew and the Phœnician; but, unless some double inscription, in Greek or other known tongue, and in the Etruscan, be discovered, there is no hope of our ever being able to translate any of the numerous inscriptions which remain. Niebuhr is of opinion, that the Etruscans derived their alphabet immediately from the Phœnicians. This conclusion, he says, could not be deduced from the mode of writing from right to left, but it is evident, from the omission of the short vowels, and the practice of noting the double consonants by a single letter, as well as from the absence of the vowel o. They did not, however, follow the Phœnicians in designating numbers by letter, but adopted that mode of notation which has been called the Roman numerals.

The Etruscans are said to have invented tragedy, and many such compositions once existed in the language. In other branches of literature they are also supposed to have excelled. Their scientific knowledge was as varied as that of other nations, whose names are known and honoured among us. Their mode of subdividing time was peculiar, and yet remarkably accurate, a fact which does not cause any surprise to those who are acquainted with the universal belief in astrology, which prevailed among

all the ancient nations. This mode of divination was probably adopted by the Etruscans, for we find their aruspices making known in the year 666 u.c. that the secular year of the Etruscans was drawing to a close, and that the nation would soon be destroyed, which was in truth the case. The mode of divination more commonly adopted was that by the entrails of victims, and lightning, the latter being a secret among them.

From this brief account of the Etruscans, and the antiquities which have been discovered, we may learn that they were in a high state of civilization, and practised the arts, particularly painting, with great success. Whatever may have been their origin, their earliest works have a strong resemblance to those of Egypt, but in later periods they introduced more grace and elegance into their designs, and caught some of the beauty which pervades every production of the Grecian school. They indulged in the use of strong and positive colours, and were destitute of that knowledge of the harmony and contrast of colours which gives so much reality and life to all the modern works of art. Painting was introduced in the decoration of houses and tombs, and it is probable that the mode did not much differ from that which was practised in after ages in Pompeii; for Roman art was, as we have already mentioned, drawn from Etruria.

When we turn to examine the state of art among the Romans, we are surprised to find an entire destitution of native talent. During the whole period of the existence of Rome as a great empire, and ultimately as the arbitrator and governor of the destiny of nations; professing to be as far superior to all other people in the practice of the arts as in moral and physical courage, there did not exist a single painter of such eminence as to warrant the transmission of his name to posterity, as worthy association with the artists of Greece. It is not, we think, difficult to account for this singular fact. The Romans were, essentially, a turbulent and cruel people, who delighted in the exercise of physical strength and prowess, and in the early periods of their history certainly esteemed the arts unworthy of their regard and beneath their patronage; nor would they, in all probability, ever have paid the slightest attention to them had they not administered to their national vanity. We look in vain to the works of the Romans for any new adaptation of the principles of taste discovered by the Greeks. Their best works were produced by Etruscan and Greek artists, who adopted the styles peculiar to their native countries; but, although they followed the standards of excellence, to which their minds had been directed by patriotism and early

associations, they had lost their genius or skill with their liberty, and departed from the simplicity and grace which distinguished the works of their ancestors in happier times. When the Romans began to patronize the arts, and the best informed and most talented men among them cultivated painting and architecture, the works of the Greek painters, or more properly the best copies of them, were collected, and as the demand increased, the copies were multiplied.

With this view of the Roman character, and of the condition of the arts of design in the days of Roman magnificence and conquest, every one must coincide who will carefully examine the claims of their works upon our estimation, and the circumstances under which they were produced. "After the conquest of Greece," says an excellent writer on painting, "and the removal of the arts and artists to Rome, the genius of painting seems to have left the world. The Roman school of painting and sculpture is scarcely worth a single thought. In the last years of the republic the art sunk rapidly. Augustus tried to revive it, but though the pupils and descendants of the illustrious dead attempted to second his views, and though the writings of Apelles, Euphranor, and Pamphilius, were all in existence, and their principles known and acted upon, genius was no where to be found. That divine spark, with its attendant whisper, unseen, but not unheard, which ever attends the gifted who are born for great objects, whether it supported Columbus amid the storms of the Atlantic, Alexander as he plunged into Asia, Napoleon as he rushed into Italy, Wellington at Waterloo, Michael Angelo when he painted the Sistine Chapel, Raffaele when he entered the Vatican, or Phidias when he adorned the Parthenon; that supernatural incomprehensible something which inspires hope, 'when the whole world seems adverse to desert,' was gone from the earth like the glory which had blazed in the temple. All that the savage, splendid, imperial Romans could do, all the honours and riches they had to confer, were bestowed in vain."

We must, however, turn from this general consideration of the art of painting, to a more particular account of its introduction in the decoration of public and private buildings. The circumstance which probably first attracted the attention of the Romans to painting as an art worthy of their encouragement and patronage,—for we do not believe that they ever practised it extensively,—was the exhibition by Valerius Messala, of a picture of the battle in which he defeated Hiero. This was in the year 489 u.c. Previous

to this period, painting was probably entirely confined to the decoration of houses, but in what manner it was so used it is difficult to determine. The walls of buildings were, we think, painted with figures, for at a later period Vitruvius complains of the introduction of a new style, which had taken the place of the representations of shepherds and gods, with which the walls had been before decorated. The art was afterwards employed for scenic representations, and not till then was it duly appreciated by the Romans.

In the time of Augustus, or at a period not long precedent, the style of decoration now called arabesque was introduced, and it was of this that Vitruvius complained as being contrary to nature, and therefore utterly unworthy of the esteem in which it appears to have been held. But, whatever may be the impropriety of the style itself, the introduction of it in Roman decoration gives us a favourable impression of the improvements which had been made in the art. But the Romans had no just appreciation of the truly beautiful in nature, and although always advancing in the arts during the short period in which they may be said to have existed as a nation, were constantly wandering into by-paths in search of some thing more showy and luxurious than could be found in the more direct pursuit of beauty and elegance. Both Pliny and Vitruvius complain that the noble and rich were fonder of gold and glitter than purity of design, or pathos of expression, or perfection of form, overwhelmed with colour from all the countries of the earth, with double the advantages of Polygnotus, Zeuxis, and Aristides. But it was probably in the baths, both public and private, that the Romans expended all the resources of colour, the walls of which were decorated with gorgeous paintings, either in the grotesque style, now called the arabesque, or in representations of ancient fables, suited to the object of the building.

From what we have here stated, it will be understood that we consider the Romans to have been patrons of the art of painting in the later periods of their history, but we doubt whether the art was ever followed by the citizens themselves. This is partly to be attributed to their national character, and partly to the ease with which they were able to obtain the best paintings and painters of the nations they had conquered. We may form some idea of the wholesale importation of Greek paintings, from the statement that in the triumphal procession of Paulus Æmilius there were two hundred and fifty chariots filled with statues and pictures.

In the seventy-ninth year of the Christian era the city of Pompeii, with

Herculaneum and the surrounding country, were destroyed by an earthquake. After an entombment of about seventeen hundred years, the ashes with which the former city was covered were removed, and an ancient Roman town was presented to our examination. With regard to it, all those agents which so silently but certainly destroy the proudest with the meaner specimens of human ingenuity and skill, suspended their operations. Had Pompeii been deserted by its inhabitants at the commencement of the Christian era instead of having been covered by the ashes of Vesuvius, and left, uninjured or untouched by man, to the quiet influence of natural causes, the sunshine and the rain, the change of seasons and temperature, it would have been now, if any relic had remained, a mass of unintelligible ruin, a fit subject for the speculations of a self-styled antiquary, but for the illustration of the history and manners of the people by whom it was inhabited, and the nation of which they formed a part, utterly useless. To the Pompeii which has been dug out of the cinders of Vesuvius we are indebted for a more accurate acquaintance with the habits of the Roman people, their mode of building and their style of decoration, than could have been communicated by the most elaborate and detailed description of their best writers, had they left us a description of the impressions produced on their own minds. We walk now in the streets of an ancient Roman city, we enter the houses, view the accommodations, observe the instruments and utensils, as they were left by their owners, examine the temples, and wander among the tombs, and with a slight effort of the imagination we may people it with its ancient inhabitants.

Pompeii was once a place of considerable importance, and is often mentioned by the Latin authors, who speak of it as a sea-port. Previous to that awful catastrophe by which it was buried, it was much injured, and almost destroyed, by an earthquake, in the reign of Tiberius, which more or less affected the whole of Campania, and, before these evils could be repaired, it was nearly levelled by a violent storm. The loss of property by the inhabitants of Pompeii was so great, and their sufferings so severe at this time, that Tiberius was induced to give them some assistance from the royal treasury. Workmen were engaged in repairing the buildings at the very moment that it was overwhelmed; and the ruinous state in which some of them are found, is to be attributed to the injury they received at that period, and not to the convulsion by which the city was buried.

Of all the public buildings none are perhaps more interesting to us, in

tracing the application of the art of painting to the decoration of buildings, than the Temple of Venus, or as it has been supposed by some authors, the Temple of Bacchus. We will quote Mr. Donaldson's description: "In extent this is the largest temple near the Forum, and in magnificence of decoration, taken as a whole, appears to have eclipsed every other edifice. The court, between the walls, is one hundred feet wide, by one hundred and eighty feet long; a noble range of columns surrounded the whole area, rendered still more imposing by numerous pedestals and statues: in the centre is the cella of the temple, which was once adorned with a magnificent peristyle, elevated almost nine feet above the pavement of the court, and to which a broad flight of marble steps afforded an easy access. The walls of the court are covered with paintings of the most interesting description. They are in vivid colours, and represent generally landscapes, views of country houses, interiors of rooms, with male and female figures: in several compositions figures are drawn, sporting among themselves, sacrificing to Priapus, contending with crocodiles, or occupied in domestic duties; nor must we omit a painting of Hector, tied to the car of Achilles, and one of Agamemnon and Achilles.

"At the end of the court, opposite the entrance, is a small chamber, which possesses an invaluable picture of Bacchus and Silenus, the former holding the thyrsus in one hand and a vase in the other: Silenus appears with his lyre instructing the god. For some years the temple was supposed, upon the evidence of this picture, to be dedicated to Bacchus. But the fragments of two statues of Venus, and a very remarkable inscription, have given reason for the adoption of the present name."

Taking this description of the decoration of the Temple of Venus at Pompeii as a general illustration of the manner in which the public buildings, and the religious edifices in particular, were finished, it would appear that the walls were painted with a variety of subjects, and that these were not always selected with so close a regard to the purpose for which the building was erected, as we should think necessary. This mode of decoration could not be generally adopted in the present day; not from any want of propriety in the style itself, but from its costliness. We are accustomed to the works of the best artists, not only in public exhibitions but in the houses of the middle classes; and any productions inferior to these would be viewed without pleasure if introduced in stucco. To obtain the works of the most admired artists, in general decoration, a great cost must be incurred, if indeed they could be at all induced to expend their time upon works of this class. Among the Greeks' and

Romans, the best artists were thus employed—it was their proper pursuit; and upon the walls of their public buildings they exhibited all their skill, from feelings of devotion and patriotism, as well as from a consciousness that they had no opportunity so available of exhibiting their talent and of earning the rich reward of praise, which was the principal if not only encouragement to their exertion.

Of the decoration of the dwelling-houses of the Romans, we should have had but little information, had our knowledge depended entirely upon the obscure hints and passing allusions of their writers. In the ancient Pompeii, however, our curiosity is fully satisfied, for we there enter their houses, and by personal observation determine the question which was so full of difficulty before this city was restored from its grave.

The Romans, whose national characteristic was a love of display and ostentatious grandeur, expended their talents and wealth upon their public buildings. The habitations of the lower classes were mean and inconvenient, which was one cause of their spending so much time abroad, and in places of public resort. The houses of the higher classes, however, though generally small, and limited in convenience, except those establishments called villas, were frequently decorated in the most costly manner. The rooms were commonly arranged round small open courts, and were finished in a style consistent with the purpose for which they were to be employed. Generally speaking, they were commodious in size: the pavements were formed of mosaics, and the walls were painted in appropriate designs. The latter were frequently divided into compartments, separated by ornamental designs, and in them were represented landscapes, or figures. In all these paintings there is a great want of perspective, and the colours are too positive to please a modern eye, red, blue, and yellow, being predominant. It was a common plan to paint on a black ground, and the effect is pleasing. The grotesque, a style of decoration which, according to Pliny, was introduced by Ludius, a painter who lived in the reign of Augustus, is very common at Pompeii. These ornaments, although justly blamed by reason, as exceedingly ridiculous, are frequently executed with much grace and elegance.

Without entering more at large upon this subject, we will close our brief review of the style of house-painting adopted by the Romans, with another quotation from Mr. Donaldson's work on Pompeii, a passage which brings the subject fully before the mind of the reader.

“The paintings which decorate both the exterior and interior of the

houses of Pompeii, shed a lively and striking character over those edifices, peculiar to them. The capricious arrangement of design, variety of decoration, brilliancy of colour, and boldness of execution, concur to render these paintings worthy the interest they excite. It is supposed, that the practice of colouring the walls of houses was general even in the time of Tarquin; but, until the reign of Augustus, it does not appear that the pretensions of the early Romans went beyond a simple tint. Under that emperor, however, art assumed a bolder aspect, and a depraved taste prevailed of colouring the walls with panels of varied colours, interspersed with landscapes, animals, and figures, until the primitive simplicity degenerated to a most luxurious profusion. The Pompeians appear to have admired gaudy colours to excess; and even when the walls of the court, the hall, or the temple, were divided into apparent courses of stone, each block was painted with the most vivid tints. More generally, the walls were divided, above a lofty marble plinth, into simple compartments, the ground of which was some dark tint, enclosed in lines of a lighter colour, and the centre occupied by a panel, or a small object, such as a bird, an animal, or instrument. The walls of gardens, or open porticoes, were sometimes decorated to the height of three or four feet, with a trellis, above which arose shrubs, trees, and flowers, interspersed with numerous birds of the rarest plumage. A third species combined more complex subjects, and the introduction of a certain capricious and artificial system of architectural arrangement, composed of slender pillars, diminutive entablatures, and pedestals, with the addition of figures, festoons, birds, reptiles, and creeping lichens."

In the reign of Constantine every inducement was held out to the artist, but there was then a destitution of all that talent which was required to raise Constantinople to the dignity which the emperor so earnestly desired; and the views which were entertained by the Christians of that day, would have repressed it had it been in existence, although large sums were ready to be expended. Palaces were erected at an enormous cost; churches were reared, and baths and other public buildings were established. For all these, paintings were required, and especially for the churches, in which pictures of Christ, the virgin, and the apostles, were suspended. It was the time of a great movement. Christianity, which had for many years been the mark for scorn and persecution, had been grafted upon paganism; the prejudices of men had been worn down by time, and in Syria, as well as in Italy, the minds of men were busied in carrying out the vast, the baneful compromise

of truth, which had, it is true, produced a momentary unanimity, but was destined in future ages, to throw a deep and almost death-like shadow over the Christian church. The works of preceding ages were removed or destroyed; in part to establish the new capital as the museum of art, as well as the centre of the monarchy, and in part to banish all recollection of former idolatry, with the objects to which worship had been paid. The destruction of the fine statues and paintings, many of which were the most worthy productions of the ancient Greek artists, may be traced to a spirit of fanaticism and proselytism, but the buildings in which these were deposited were thrown down, to provide suitable materials for the construction of the new capital. Hence we find that the noblest structures of Rome furnished parts of those erected in Constantinople. One of the earliest instances of this appropriation of the sculptures of former ages, is in the arch of Constantine, for the erection of which, stones were taken from the arches of Trajan and Marcus Aurelius, as well as from other buildings at Rome.

"When the liberal arts," says Ciampini, "were, together with the Roman empire, rapidly declining, so great a corruption and barbarity prevailed, that columns, bases, and capitals, carved with the most exquisite art, were every where cut out from the noblest buildings of the ancient emperors. To them were added shapeless masses, formed by those new masons, rather than architects, and these were heaped one upon another, to the disgrace of the art, and with rude and sordid barbarity. Hence in those edifices may be seen at one and the same time, many things which contradict one another; such, for instance, as columns of the same order, some with Corinthian, some with Ionic bases, and capitals of both sorts; the pavements, covered partly with sacred, and partly with profane inscriptions, some of them mutilated, and some of them incomplete; one and the same frieze or architrave, sometimes very skilfully wrought, sometimes altogether barbarously hewed out, rather than carved. Of this, the arch dedicated by the senate and people of Rome to Constantine, is an instance, where the unskilfulness of that age, is manifest, since statues taken from the arch of Trajan, and cornices, columns, and perhaps the very symmetry of the whole, borrowed thence, have been corrupted by these masons with barbarous carvings, which they have placed on the bases, and above the curves of the arches, and elsewhere. From the conjunction of works so dissimilar, the ignorance of those artificers who flourished in the age of Constantine will most evidently appear, in proportion as these unskilful embossments of a later age are compared with the very

exquisite carvings of the preceding times. How great injury architecture, as well as the other arts, had suffered from the hand of time, is plain from these facts, since, in the fourth century, when some sparks of the former skill were still remaining; it had already fallen so much from its ancient dignity."

Mosaics were at this time the favourite decorations in all buildings, and after Claudius had introduced mosaic pictures in Indian patterns, which style was previously confined to the decoration of pavements, an effect was sought even in this manner. It is scarcely possible to imagine men professing architecture, or the patronage of it, with the finest specimens of Greek art before them, the sight of which has been sufficient to rouse the sleeping spirit of the arts from a death-like slumber, so utterly lost to the appreciation of beauty and grace, as to descend to the paltry trifling of painting mosaic pictures upon the walls of the most celebrated edifices of the age. Yet there is abundant evidence to prove that this was constantly done; and to mention but one instance, Commodus ordered a portrait of Pescennius Niger to be painted in mosaic on a wall in a room of his palace. This style of decoration may in fact, be considered as one of the peculiarities of the Græco-barbaro architecture, by which characteristic name, the architecture of the period is known. During the reign of Justinian it was ordered, that encaustic painting, being common and vulgar, should not be used on the walls and ceilings of the public buildings, but that mosaic, marble, and gold, should be invariably employed; thus fixing, as it were, by a royal decree, the degradation of the arts.

There was great activity among the architects and builders in the reign of Justinian, for if we may believe the statement of Vegetius, more than five hundred architects were employed by this emperor, in various parts of the kingdom, in restoring the buildings which had fallen to decay, and in erecting new ones in the various provinces acquired from the emperor of the West. The church of Santa Sophia was built during the reign of Justinian, and it was upon its completion that he uttered the exclamation, "I have surpassed thee, O Solomon!" The cupola and pavement were finished in mosaic, but the walls were decorated with paintings.

It is evident, from all the records of the age, that after the government had been removed from Rome to Constantinople, the fall of the arts was greatly accelerated. The darkness which soon after fell upon society, and the destitution of all taste which produced a love of the gaudy and glittering

styles of decoration, to which we have alluded, were not perhaps absolutely the results of the establishment of the western capital, but the convulsions which the empire at that time suffered hastened the previously rapid fall of the artificial civilization of the Roman people. When all the adventitious circumstances which threw a ray of glory around the Roman name were withdrawn, it was at once perceptible that the people were as unsuited to sustain as to practise the arts. The character of the patron has in all cases a strong influence upon the character of the artist, which extends even to the modification, if not the entire change of the powers of genius. We have a mournful instance of this in the Greek artists, who, when employed by the Romans, lost much of the energy and spirit of their predecessors; and although the love of grace and beauty was never entirely eradicated from the minds of this remarkable people, the artists of the later ages insensibly imbibed enough of the Roman taste to lessen the excellence of their own genius. In all the works of the Greek painters, however, there was evidence of an innate love of the beautiful. They were frequently employed in painting pictures of Christ for the churches, and they usually represented some attribute allegorically. The Saviour was, therefore, painted as a beautiful youth, crushing a lion beneath his feet, or as a young shepherd among his flock, carrying the lambs in his arms. This mode of representation, however, was not that which the fathers of the church in the fifth and sixth centuries thought most suitable for the decoration of religious structures, and they consequently ordered that he should be painted in the agony of the cross. But such a subject was not suited to the character of the Greeks, and although they followed the injunction of the church, Christ was painted on the cross with a smile of triumph, which produced a feeling in the spectator inconsistent with the gloomy fanaticism of the age.

We must now pass over that long period of history during which the arts remained in a state of stupor, and proceed to make a few remarks upon the use of painting in decoration, after the introduction of oil colours, chiefly confining our attention to the progress of the art in our own country.

It has been long supposed that painting in oil was discovered by John Van Eyck, at the beginning of the fifteenth century, but from various documents which have in our own day been discovered, there is much reason to doubt the truth of this assertion. M. Mérimée, to whose excellent work we have already referred, in a previous part of this book, is of opinion that Van Eyck deserves the honour which has been so long awarded to him.

"Some learned men," he says, "have maintained that this art was practised long before the era in which that painter lived. But, supposing they could demonstrate the truth of their assertions, still we are not bound to conclude that Van Eyck had any knowledge of whatever attempts may have been made in that way before his time; and he cannot be deprived of the merit attached to a discovery like this, so important to the arts. One thing, however, is quite clear, which is, that in the time of Van Eyck, the arts had made such progress that the discovery of painting in oil could not have been much longer delayed. This event was in some degree inevitable; and it is surprising that the invention did not take place at the same time in all those countries where the arts were successfully cultivated. At that period the artists all painted in distemper, or, as it is commonly called, body colours, and they afterwards coated their pictures with varnish, which communicated a transparency and brightness to the colours, defending them, at the same time, against the injurious action of the atmosphere."

It appears, however, from the Close Rolls, that oil painting was used in decoration in the reign of Henry the Third of England, in the year 1239. "The Rotuli Litterarum Clausarum, or Close Rolls, are a series of parchment rolls, commencing with the sixth year of the reign of King John, anno Domini 1204, on which are recorded or enrolled, all mandates, letters, and writs, of a private nature. They are denominated Close, in contradistinction to another series of rolls called Patent. The entries registered on the Close Rolls, are letters addressed in the king's name to individuals, for special and particular purposes, and were folded, or closed up, and sealed on the outside with the great seal."

In these Close Rolls is found an order issued by King Henry, in the year 1239, ordering the payment of money for material and labour, in painting the queen's chamber, at Westminster; and from the mention of oil and varnish, it may be fairly inferred, that the former substance was used as a medium of colour.

"The king to his treasurer and chamberlains greeting. Deliver of our treasure to Odo the goldsmith and Edward his son, one hundred and seventeen shillings and ten pence, for oil, varnish, and colours bought, and for pictures made in the chamber of our queen, at Westminster, from the octaves of the Holy Trinity, in the twenty-third year of our reign, to the Feast of St. Barnabas, the Apostle, in the same year, namely, for fifteen days."

What these pictures were cannot now be determined, but of the style of

decoration we shall presently be able to give some account. It seems, however, probable, as Mr. Britton suggests, that these preparations were made for the queen's accouchement, as her first son Edward was born on the 16th of June, 1239, five days only after the last date mentioned in the record.

Henry the Third lived much at his palace in Westminster, and during the whole of his reign exerted his power, as well as drained his exchequer, to raise Westminster to an importance greater than even London itself. This is evident, from his frequent and severe exactions upon the citizens of London, and especially from that unjust order by which he established St. Edward's Fair, at Westminster, and compelled them to shut their shops for fifteen days and carry their merchandize thither, that the duties levied by the abbot of Westminster upon the goods exposed for sale, might aid the building of the Abbey. We cannot with Walpole justify the prodigality and oppression of this monarch, by an exhibition of his skill in the choice of men, who by the exercise of their arts have thrown a ray of glory over this otherwise unfortunate reign; but we may ask with that author, "who will own that he had not rather employ Master William and Edward of Westminster to paint the *Gestes* of the kings of Antioch, than imitate the son in his barbarities in Wales, and usurpations in Scotland?"

From the Close Rolls and other records of this age, it appears that, during the reign of Henry the Third many additions were made to the palace of Westminster, and the style of decoration was improved. Immediately after his return from the unfortunate expedition to France, he commenced the erection of a large chamber which was called the Chamber of the Holy Cross. For this work a mandate was issued to the sheriff of Kent, to purchase and send to Westminster with all possible speed, one hundred barge loads of grey stone; and in May, 1244, an order was given to the treasurer and chamberlains, to pay Edward of Westminster nineteen hundred and forty-nine pounds thirteen shillings and five pence halfpenny, which he had expended in the erection "of a new chamber near our Hall at Westminster, and of our conduit, and in other works there, which we enjoined him to have constructed."

In 1245, Henry commenced the rebuilding of the Abbey Church of Westminster, and Matthew Paris has pointed out the manner in which this noble work was executed. "The king," he says, "moved by his devotional regard for St. Edward, commanded that the church of St. Peter at Westminster should be enlarged; and the old walls, with the tower of the eastern

part being overthrown, were constructed anew and more handsomely, by artificers, whom the king at his own cost procured; the new work being fitted to the residue or western part." On the thirteenth of October, 1269, the Abbey was first opened for the performance of divine worship, and at that time the eastern part, with the choir, to some distance beyond the transept, was completed. The remains of Edward the Confessor were then removed "into ye chapell at ye backe of ye hygh aulter, and there layde in a ryche shrine."

The decoration of rooms at this period, chiefly consisted in painting the walls with representations of sacred subjects or scenes from history; but there are not unfrequent allusions to paintings in representation of a curtain. In 1236, for instance, an order was given to the king's treasurer "to have the king's great chamber at Westminster, painted of a good green colour in the manner of a curtain; and in the great gable of the same chamber to have painted this motto,

'Ke ne dune ke ne tine, ne pret ke desire:'

And to have the king's little wardrobe painted green like a curtain, so that the king on his first coming there may find the above-mentioned chamber and wardrobe painted and ornamented as directed."

In August, 1250, another order was given concerning the decoration of the great chamber at Westmins'er. It is addressed to Odo the goldsmith, who is commanded to put aside the picture which was being painted "beneath the large historical picture of the said chamber, with the scrolls containing the figures and representations of lions, birds, and other beasts, and to paint it green after the manner of a curtain, or hanging, so that the effect of the great history may be kept unimpaired."

Historical paintings were commonly introduced in the decoration of rooms, and those subjects were chosen which seemed to the proprietor, most suited to the purposes for which the room was to be employed, or those in which he took most interest. Henry the Third frequently selected subjects from the siege of Antioch, in which his uncle Richard had so much distinguished himself. In the twenty-first year of his reign, a mandate was issued for painting the wainscot of his chamber under the chapel at the palace of Clarendon, in Wiltshire, with the history of Antioch, and the single combat of king Richard. In the year 1251, an order was given to Edward of Westminster to paint "the low chamber in the king's garden;" and from the

circumstance of its being afterwards called the Antioch chamber, the subjects were probably selected from the events which attended the siege of that place.

In 1237 an order was given for the painting the queen's chamber behind her chapel, which gives us a further illustration of the decorations of the period. The walls of the private chamber of that chamber were to be wainscoted, and the chamber itself lined, and a list or border to be made, "and well painted with images of our Lord and angels, with incense pots." It was also ordered that the four evangelists should be painted in the chamber, and a crystal vase be provided for relics. In the previous year, a border was ordered for the back of the king's seat, in the Chapel of St. Stephen, at Westminster, and also at the back of the queen's seat in another part of the chapel, of a green colour. In a mandate dated the fourteenth of August, 1250, we have a still more interesting fact communicated, for it brings before us the manner in which the chapel itself was painted. It was tested at Bridgewater, and ordered Edward of Westminster "to cause pictures of the Apostles to be painted around the walls of St. Stephen's Chapel, and on the western side the day of judgment; and, in like manner, to have the figure of the blessed Virgin Mary painted on a tablet or panel; so that the whole may be ready at the king's coming."

Edward the First was, like his father, a great builder, and a patron of the arts, though his desire of conquest, and the unjust wars it produced, prevented him from giving them that continued and active encouragement which they would otherwise have received from him. During this reign many noble ecclesiastical structures were raised, and the general style of decoration was perhaps in some degree improved. In 1292 and the two following years, some extensive works were in progress at Westminster. "The wages of the painters in those years," says Mr. Brayley, "were as follows:—Master Walter, the principal painter, was paid fourteen pence a day, the others smaller sums, in general from seven pence to three pence a day. Two individuals, Andrew and Giletto, probably Italians, had conjointly six and eight pence for six days, and eight shillings in another week for the same time.

"Among the articles charged in these accounts, are several which clearly demonstrate that painting in oil colours formed a part of the decorations that were in progress. Oil, and cole, and varnish, with white and red-lead, vermilion, and azure, and sinople, are repeatedly mentioned; together with gold and silver (*leaf*), of which considerable quantities were used. These

articles, as Mr. Hawkins has remarked, 'could not have been wanted for mere house-painting;' and hence, as well as from the length of time the artists were employed, he judiciously infers, 'that the paintings were not even heraldic bearings (exclusively) but human figures; either portraits or ideal representations, and historical subjects, such as were afterwards painted on the walls when the chapel was rebuilt by Henry the Third.'

"From the prices mentioned in these rolls, it appears that a 'pottle of oil' cost five pence or six pence; a pound of red-lead two pence; a pound of white-lead three halfpence, or a penny three farthings; a pound of size three pence halfpenny; a quartern of azure one shilling; a pound of red varnish three pence halfpenny and four pence; a quartern of sinople one shilling; a pound of green five pence halfpenny; one hundred (probably books) of gold leaf three shillings and four pence; one hundred of silver leaf six pence; and a quartern of vermilion (probably of a hundred weight) six shillings and five pence.'

"In the reign of Edward the First an attempt was made to render the castles, which had before been constructed entirely with a view to defence, more suitable as places of habitation. Not only were large halls introduced for the purpose of feasting the retainers of the lord, but a great variety of small apartments, which were decorated with historical paintings, tapestry, and various carvings. These small rooms were sometimes very numerous, and ornamented in different styles, according to the purposes for which they were to be employed, and the persons by whom they were to be occupied.

"Adjoining to, or nearly connected with the hall, was a spacious room, usually having a bay window, which looked into the quadrangle or court. Here the lord received his family or special guests before dinner, and retired into it when that ceremony was finished. It was adorned with the richest tapestry, and cushions of embroidery, by the ladies themselves, and was distinguished as the presence or privy chamber. For the females of the family there was another similar apartment, in which they passed their time, and which was dedicated to their occupations and amusements, known as my lady's bower or parlour, where they received visitors." Edward the First constructed a large hall at the Castle of Conway, which was one hundred and twenty-nine feet long, thirty-one feet wide, and twenty-two feet high. These large halls, which became common in all the residences of the nobility, were built sufficiently large for a knight to ride up to the dais

or high table, in the manner practised in the coronation feast. To this Chancer refers :

“ In at the halle dore al suddenlie
There came a knight upon a stede,
And up he rideth to the highe borde.”

From these remarks it must not be supposed that the rooms in castles were not painted before the reign of Edward the First. More attention was then paid to the comfort of the inmates, but such rooms as were formed, were decorated with every attention to their elegance, if not convenience. In the year 1233, and the seventeenth of Henry the Third, a precept was issued to the sheriff of Southampton, which was as follows: “Precept to the sheriff of Southampton; that he shall cause the king’s chamber wainscot in the castle of Winchester, to be painted with the same pictures as formerly, and that he shall account for the cost.” From this it is evident that the painting of the walls in castles, was of even an earlier date than the 17th year of Henry the Third.

Wainscoting also, was common at this period. In the Close Rolls we find the following order, addressed to Henry Pateshull, the king’s treasurer. “We order that you have the chancel of the blessed Virgin Mary, in the church of St. Peter in the baily of our Tower of London, and the chancel of St. Peter within the said church, to be well and properly wainscoted, for the space of four feet beyond the stalls erected for the use of ourself and queen, and that the said stalls be painted with a small figure of the Virgin Mary standing in her shrine,—the figures of the Saints Peter, Nicholas, and Catherine, the beam beyond the altar of St. Peter, and the small crucifix with its figures, to be painted anew with fresh colours. And that ye likewise cause two pictures to be painted with the best colours, with the histories of St. Nicholas and St. Catherine at the altar of the said saint, in the said church, with two fair cherubims standing to the right and left of the crucifix, and having a cheerful countenance, and also a marble font, having pillars of marble neatly carved.”

It may also be mentioned, that a style of decoration which may be considered still more elegant, prevailed at this period,—that of studding the ceilings and walls of rooms and chambers, with stars of gold, in apartments upon a ground of green or blue. Representations of such chambers are found in many illuminated manuscripts. An order for such a decoration is in existence, dated 22 Henry the Third. “Precept to the sheriff of South-

ampton, that he cause the chamber at Winchester to be painted of a green colour, and with stars of gold (and compartments) in which may be painted histories from the Old and New Testament."

The preservation of the records of the reign of Henry the Third, has been of great importance in aiding us to trace the progress of the art of decoration, for the notices of the works carried on during the reign of the first and second Edward, are comparatively few and uncertain, but it may be safely concluded that the styles adopted by their predecessor were not unknown to the workmen of their day.

The reign of Edward the Second was peculiarly unfavourable to the progress of the arts. This is not to be entirely traced, as some persons suppose, to the circumstance that a strong feeling of rebellion against the monarch, or more properly his favourites, was working in the minds of all classes of the community; for it has happened, on more than one occasion, that the noblest productions of the imagination have had their birth when society has been disturbed by internal commotions. Genius is not developed in the uniform tameness of every-day life; it requires the spring of some strong internal emotion, and this is most commonly the result of external circumstances. Men of lively fancy, and strong imagination, too frequently resort to trifling and even mean expedients, to create those outward impressions favourable to an exhibition of their powers; but it is chiefly under the pressure of great occasions that men attempt and perform great works. That which is true of individuals is equally so of nations. It is not a state of wavering dissatisfaction that is favourable to the progress of the arts, for that is a condition of mind unfit for the advance of society, either in virtue or refinement. When a nation is agitated by a public struggle for advancement, the strongest efforts are made by all great minds towards the perfection of their favourite pursuits. But there was nothing of this kind during the reign of the second Edward. The energies of society were not peculiarly great, nor would the improvements as viewed by posterity have been in any degree striking, had the monarch been less the object of public contempt and dissatisfaction. So strangely was his character distinguished by its weakness, that no one act of his life can be mentioned as redeeming him from the entire dominion of vice. Immediately after the death of his father, though under the bond of the most solemn oath to prosecute the Scottish war, he returned into England, when he had advanced into Scotland no further than Cumnock, in Ayrshire; and having recalled his abandoned favourite, Piers

de Gaveston, who had been justly banished, freely gave him both wealth and title, conferring on him the earldom of Cornwall and the lordship of the Isle of Man. It is not our province to trace the history of this foolish and profligate prince, or to describe the characters of those favourites who hastened his ruin, and justly bear a part of the obloquy which is attached to all who were engaged in the consummation of that tragic scene which terminated his existence; but the following extract from an authentic manuscript, in old French, is too characteristic to be omitted in any allusion to the qualities of mind which distinguished Edward the Second.

“Paid to the king himself to play at cross and pile (tossing up) by the hands of Richard de Merewith, receiver of the treasury, 12*d*.

“Paid to Henry, the king’s barber, for money which he lent to the king to play at cross and pile, 5*s*.

“Paid to Piers Barrard, usher of the king’s chamber, for money which he lent to the king, and which he lost at cross and pile, to Mons. Robt. Wattewylle, 8*d*.

“Paid to James de St. Albans, the king’s painter, who danced on a table before the king, and made him laugh heartily, being a gift by the king’s own hands, in aid of him, his wife, and children, 50*s*.

“Paid at the lodge at Walmer, when the king was stag hunting there, to Morris Ken, of the kitchen, because he rode before the king, and often fell from his horse, at which the king laughed heartily; a gift, by command, 20*s*.”

But, although the character of the monarch and of the period, was unfavourable to the strong development of any of the fine arts, some extensive architectural works were in progress during his reign. The restoration of St. Stephen’s Chapel was commenced, and large sums of money were expended both at the palace and at Westminster. “The little hall at Westminster,” according to a roll belonging to the king’s remembrancer’s office, “which was burnt in the time of the king’s father, was completely repaired and new raised, and the walls of the same hall, both within and without, were provided with corbels, of Caen and Reygate freestone. The gables were heightened and coped, and the walls in many parts strengthened and embattled, and the upper masonry was bound together with large iron ties, with tinned heads, on account of the great weight and size of the timbers.”

There are many reasons to suppose that tapestry and embroidered cloths

were extensively employed in decoration during the reign of Edward the Second, and among other reasons we might mention the circumstance of their being used in large quantities in the hall and other apartments at Westminster, at the time of the coronation of his son. Brayley and Britton have given, in their History of the Ancient Palace and late Houses of Parliament at Westminster, a translation of part of a roll preserved in the Augmentation Office, intituled "*Contrarotulus Johannis de Feryby, Contrarotulatoris Thomæ de Useflete Clerici Magnæ Garderobæ Regis, per eundem Regem et Concilium deputati, de diversis rebus emptis et expensis circa Coronacionem dicti Dom. Regis Edw. tercii a Conquestu, in Ecclesia beati Petri Westm' et in Palacio ejusd. videlicet primo die Februarii, anno regni sui primo; ut patet infra.*" In this interesting record we have an account of the various articles employed in the decoration of the hall and church at the coronation of Edward the Third. One or two items we will extract, as the reader will probably obtain from them a better conception of the style of decoration, than from any description we should give, which would be in fact only a transcript of the author's imagination, and would probably greatly differ from that which the several readers may themselves form from the perusal of the document itself.

The ornament of the king's seat on the day of his coronation, in the church of Westminster:—

"For the fitting up and ornament of the seat of King Edward the Third, on the day of his coronation in the church of Westminster, February the first, in the first year of his reign: viz., cloth of gold, with diaper work on silk, cloth of gold on linen, samite, velvet, tapestry, with cushions for the chamber, used for the royal seat of Edward the Third, by the survey and testimony of John de Feriby, appointed clerk for this purpose, by the seneschal and treasurer of the household:—for tapestry, of different colours, to cover the timber-work of the king's seat, twenty-one tapestries.

"The same day, for cloth of gold on silk, to hang around the same seat, on every side, and for ornamenting the bench of the seat, six cloths and one quarter.

"The same day, for a veil or curtain to be stretched above over the king's head, sitting on the chair in the royal seat, with cords of gold and purple linen, two cloths.

"The same day, for chamber cushions, for the king's feet, sitting in the chair, five cushions.

"The same day, to hang between the cloths of gold and silk before mentioned, around the royal seat, at the sides and borders, cloth of gold on linen, twenty-two cloths.

"Item, of striped cloth (*pannus tartarus radiatus*), for the same, one cloth.

"The same day, of strong lawn, for the same, six pieces."

The ornaments of the king's chamber, before his taking the order of knighthood, were as follows:—

"For the fitting up, and ornamenting the king's chamber, in his palace, at Westminster, on the last day of January; the night before he received the order of knighthood: viz., with red tapestry, and shields of the king's arms in the corners, five pieces.

"The same day, for cushions of new samite, for the king's chapel, three cushions.

"For cushions of the same, for the chamber, after the king is knighted, six cushions.

"For bancours, for the same chamber, ornamented with different shields: viz., four red, with green borders, one green, and four murrey and blue, nine bancours.

"Item, for bancours, for the chamber before mentioned, ornamented with tapestry, and shields in the corners, with the king's arms, three bancours."

Painting of walls in oil colours and stained glass, were also common decorations during the reign of Edward the Third. Of the use of oil in painting at this period there cannot be the slightest doubt; the accounts which have reached our own day, of the decorations of St. Stephen's Chapel, which were commenced about the year 1350, are on this disputed point perfectly satisfactory; the following extracts giving the materials used in the decoration of St. Stephen's Chapel, and their prices, from Rolls in the 25th of Edward the Third, that is the year 1351, have been published by the authors already quoted, but cannot be, with propriety, omitted in this place, and will be peculiarly interesting to those for whom we are attempting to trace the progress of house-painting.

"June 26. To John Lyghtgrave, for six hundred leaves of gold, for painting the tablements of the chapel, at 5s. per hundred, £1. 10s.

"To the same, for twelve leaves of tin, for the liessers (borders) of the said tablements, 1s. . . .

"For cole and squirrels' tails, for the painting of the chapel, 3d. 3

"July 11. For nineteen pounds of white lead, for priming, at 4*d.* per lb., 6*s.* 4*d.*

"July 18. To John Matfrey, for sixty-two pounds of red lead, at 5*d.* per lb., £1. 5*s.* 10*d.*

"To Master H. de St. Albans, for four flagons of painters' oil for the painting of the chapel, 16*s.*

"July 25. To the same, for two flagons of cole, for the painting of the said chapel, 2*d.*

"To the same for half a pound of teynt, for the painting of the chapel, 2*s.*

"Aug. 8. To the same, for a pound and a half of oker, 3*d.*

"To the same, for two small earthen jars to put the colours in, 1*d.*

"For half a pound of cynephe, for the painting of the upper chapel, 17*s.* 3*d.*

"Aug. 15. To Lonyn de Bruges, for six and a half pounds of white varnish, at 9*d.* per lb., 4*s.* 10½*d.*

"Sept. 5. To Hugh de St. Albans, for half a pound of red lead, 8*d.*

"To the same, for three pounds of azure, £1. 10*s.*

"For thirty peacocks' and swans' feathers, and squirrels' tails, for the painters' pencils, 2½*d.*

"For one pair of shears to cut the leaves of tin, 2*d.*

"Sept. 19. For one pound of hog's hair, for the painters' pencils, 1*s.*

"For nineteen flagons of painters' oil, at 3*s.* 4*d.* per flagon, £3. 3*s.* 4*d.*

"To John Lyghtgrave, for six hundred leaves, at 4*s.* 6*d.* per hundred, £1. 7*s.*

"For half a pound of cotton, for laying on the gold, 7½*d.*

"Sept. 26. To John Tynbetere, for twelve dozen leaves of tin, 12*s.*

"Oct. 3. To John Lyghtgrave, for fifty-one pounds of white lead, for the painting of the chapel, at 2½*d.* per pound, 10*s.* 7½*d.*

"To the same, for two thousand three hundred and fifty leaves of gold for the same painting, at 4*s.* 6*d.* per hundred, £5. 5*s.* 9*d.*

"To the same, for three pounds of azure, at 10*s.* per lb. £1. 10*s.*

"To the same, for one pound of sinople, £1. 10*s.*

"To the same, for two pounds of vermelon, 3*s.* 4*d.*

"Oct. 10. For cole and peacocks' and swans' feathers, for the works of the chapel, 2½*d.*

"To John Lyghtgrave, for fifty-three pounds of white lead, at 3½*d.* per lb., 15*s.* 5*d.*

- "To the same, for forty-three pounds of red lead, at 4*d.* per lb., 14*s.* 6*d.*
- "To the same, for three pounds of white lead, 1*s.*
- "To the same, for two thousand six hundred and fifty leaves of gold, for the paintings of the chapel, at 4*s.* per hundred, £5. 6*s.*
- "Oct. 17. To Wm. de Hamelamsted for one cwt., two qrs., two pounds of tin for the king's works there, at £1. 2*s.* per cwt., £1. 13*s.* 5*d.*
- "Nov. 7. To Wm. Alemand, for nine hundred leaves of gold for the paintings of the chapel, at 4*s.* per hundred, £1. 16*s.*
- "Nov. 14. To the same, for seven hundred leaves of gold for the painting of the tabernacles of the chapel, £1. 8*s.*
- "To Margaret Piebaker, for half a pound of cynopre of the chapel, 10*s.*
- "To Master H. de St. Albans, for two pounds of cynopre from Montpellier, at 8*s.* per lb., 16*s.*
- "To the same, for fifty-two pounds of white varnish, at 8*d.* per lb., £1. 14*s.* 8*d.*
- "Nov. 21. To John Matfray, for two pounds of azure, at 7*s.* per lb. 14*s.*
- "To George Cosyn, for two pounds of vermelon, for the same, at 1*s.* 8*d.* per lb., 3*s.* 4*d.*
- "Dec. 5. To John Lightgrave, for three pounds of vermelon, at 2*s.* per lb., 6*s.*
- "1352. Jan. 2. To John Lambard, for two quatern of royal paper for the painters' patrons, 1*s.* 8*d.*
- "For one pair of scales, to weigh the different painters' colours, 1*s.*
- "Jan. 9. To John Tynbeter, for six dozen and eight leaves of tin, for the pryntes (stamps?) for the painting of the same chapel, 6*s.* 8*d.*"

The mode which was at this time adopted to obtain journeymen painters, was one which would in the present day but ill accord with the feeling of independence and personal freedom which happily exists in every rank of society, in the lower not less than the higher. For the execution of the works at St. Stephen's chapel, however, authority was given to Hugh de St. Albans, the master of the painters, to impress such workmen as he might require, and to compel them to serve at the king's wage. The precept, tested by the king himself, at Westminster, on the 18th of March, 1350, although already quoted in several modern works, must be here introduced.

"The King to all and singular the sheriffs, mayors, bailiffs, officers, and his other lieges, as well within liberties as without, to whom, &c., greeting:—

"Know ye, that we have appointed our beloved Hugh de St. Albans, master of our painters assigned for the works to be executed at our chapel, at our palace at Westminster, to take and choose as many painters and other workmen as may be required for performing those works, in any places where it may seem expedient, either within liberties or without, in the counties of Kent, Middlesex, Essex, Surrey, and Sussex; and to cause those workmen to come to our palace aforesaid, there to remain in our service, at our wages, so long as may be necessary. And, therefore, we command you to be counselling and assisting this Hugh in doing and completing what has been stated, as often and in such manner as the said Hugh may require."

"In the year 1363, the 37th of Edward the Third, a similar authority was given to William de Walsyngham; and from the punishment which was annexed to a disregard of the king's precept, it may be supposed that some difficulty had been experienced in obtaining workmen at former periods.

"The King to all and singular the sheriffs, &c., greeting:—

"Know ye that we have appointed our beloved William de Walsyngham to take so many painters in our city of London (the fee of the church excepted) as may be sufficient for our works in St. Stephen's chapel, within our palace of Westminster, and to bring them to our palace aforesaid, for our works, at our wages, there to remain as long as may be requisite; and to arrest all who shall oppose or prove rebellious in this matter, and commit them to our prisons, until we shall otherwise have ordered their punishment. And, therefore, we command you that you should be assisting the said William, in executing and fulfilling all things before mentioned with your aid and counsel, as often and in the manner in which, by the said William on our account, you may be required."

The domestic decoration of the period during which Edward III. and Richard II. occupied the throne of England, was almost entirely confined to painting the walls with historical pictures, or hanging tapestries and rich cloths upon them. Time has left but few records of this age, although it has preserved many of a much higher date; but still we are acquainted with many of the subjects that were chosen. In a chamber of the royal palace at Westminster, all the warlike histories of the Bible, as being the parts best suiting the character of the age, were painted with great skill, and explained by a series of texts written in French. Another chamber was painted with the exploits of Richard I. in the Holy Land; and it is said, that in the palace of Winchester, the entire biblical history was painted in admirable design. All

these were, without doubt, painted in oil colours, and probably in a higher style of art than we are willing to allow as belonging to that age.

Historical paintings, and the working of tapestries, were known in this country as early as the dynasty of the Saxons. "Among the furniture of their rooms," says Mr. Sharon Turner, "we find hangings, to be suspended on the walls, most of them silken, some with the figures of golden birds in needlework, some woven, and some plain. Their love of gaudy colouring was in these as apparent as in their dress; for Aldhelm says, if finished of one colour uniform, they would not appear beautiful to the eye. In the tenth century, Edelfleda, the widow of Brithnod, Duke of Northumberland, presented to the church at Ely a curtain on which she had represented the martial exploits of her late husband, 'to preserve the memory of his great valour and virtues;' but whether this was executed in painting or in needlework, may be considered doubtful. All historians, however, agree that even in the seventh century, the art of weaving animal figures and foliage in cloths, and of embroidering them afterwards, was known, if, indeed, it was not then commonly practised. From this period to the reign of Elizabeth, tapestries were held in high estimation as hangings for rooms, and were even sufficiently valuable to be the gift of a king, and associated with the disposal of baronial residences and large estates. Thus we find that Richard the Second conveyed to Thomas Holland, Duke of Kent, the castle at Warwick and other possessions, and with them 'that suit of arras hanging which contained the history of the famous Guy, Earl of Warwick.' Tapestry, representing sacred events, or legends, were hung behind the high altar in churches, and it was for this purpose that many of the noble dames of antiquity presented their works to ecclesiastical superiors, cheered in their laborious tasks by the belief that they were by such acts facilitating their ultimate safety in a future world, and a blessing in this.

Two very remarkable men lived in the reign of Richard the Second, and as they were both connected with that art the progress of which we are tracing, they may with propriety be mentioned; one was Geoffrey Chaucer, the father of English poetry; the other William of Wykeham, the father of English architecture. Chaucer appears to have been introduced at court in the reign of Edward the Third, and for a long time to have enjoyed royal favour, and to have been intrusted with some secret negociations beyond sea. On the 13th of July, 1389, he was appointed, by a writ tested at Windsor, clerk of the works at the palace of Westminster, the tower of London, and

the mews near Charing Cross. Twelve months after this, he was ordered to proceed to the restoration of the Collegiate Church at Windsor, which was then in a state of ruins. It has been doubted whether Chaucer possessed the knowledge requisite for the fulfilment of those duties which must devolve upon a clerk of the works, but there does not seem any reason to suppose that he was unacquainted with the art of building, for it is hardly probable that he would have been selected for the office without the requisite information, as there was no lack of means to provide for him by those who were his patrons. If we might indulge imagination, it would be curious to trace the intercourse between such minds as Geoffrey Chaucer and William of Wykeham, whose name as bishop of Winchester and chancellor of England, we should have heard with indifference; but as the designer and author of the noblest specimens of architecture in England, will ever be held in reverence.

The civil commotion and dissatisfaction which disturbed society during what may be called the middle ages of British history, offer to the historian no other records than those of wars and contentions, and all those degrading vices which are ever their attendants. The improvements which had been made in the domestic manners and habits of the people were rather invaded and depressed than nurtured and encouraged. The proud circumstance of war, the daring ambition of nobles, the insolence of their retainers, and the sufferings of the people, fill up the catalogue of events. We may therefore pass over a period so barren of interest to the painter, whose art chiefly flourishes when society is in repose, or at least in a condition susceptible of improvement.

In the reigns of Henry the Seventh and his successor, the same style of decoration was adopted as had prevailed in former ages. Historical paintings on walls, tapestries, rich hangings, and painted glasses, were the most remarkable features. Extensive mansions were at this period erected, in which the characteristic details of the castles of a former age were not entirely lost, but a much greater attention to comfort was secured. "Such palaces as King Henry the Eighth erected after his own devise," says Harrison, "do represente another kind of patterne, which, as they are supposed to excell all the rest that he found standing in this realme, so they are, and shall be, a perpetual precedent unto those that do come after to follow in their works and buildings of importance. Certes, masonrie did never better flourish in England than in his time."

In the reign of Henry the Eighth the Florentine architecture was so far

introduced as to be greatly intermixed with the native style, which may be traced to the encouragement given in that reign to Italian artists. In the succeeding reigns it obtained a predominance, and in the time of James the First the debased Roman architecture of the middle ages was revived.

To trace the slight changes which were made in the style of house-painting, during the subsequent years, unto the present time, is unnecessary. The historical painting which had prevailed in earlier ages became uncommon after the reign of James the First, and the execution of interior designs in fancy woods, from which the art of graining arose, was adopted. In our own day, the painting on panels, in imitation of the French styles, has been revived, and the entire art of house-painting has received improvements greater than at any former period. The decoration of houses is now distinguished by a refinement and elegance which do not in any degree belong to the styles of former periods. With the improvements which have been introduced in the internal decoration of houses, must be associated the invention of paper-hangings, which were first intended as imitations of the tapestries and figured stuffs so commonly employed in earlier ages. Flock papers, according to Beckman, were invented by Jerome Langer, who obtained a patent, dated 1st of May, 1634. The French, however, have laid claim to the invention, in favour of one François, who is said to have practised the art in the year 1620, at Rouen. But, whoever may have been the inventor, and whenever they may have been introduced, it is certain that the use of them has greatly facilitated the domestic improvements of the age. All the styles of former periods are now more or less employed, but that which is most common consists in covering the walls with a paper printed in pattern, and painting the joiners'-work in either plain colours or in imitation of expensive or admired woods. By the adoption of this mode of finishing rooms, the residences of all classes are rendered more convenient, comfort is secured for the cleanly poor at a small cost, and elegance for the rich.

CONCLUDING REMARKS.

THE subjects which have come under our notice in considering the art of house painting are numerous; but the immediate dependence of one upon the other, must be evident to every attentive and thoughtful mind. The knowledge required by a decorator who wishes to understand his business, may be divided into four sections.

He will first require to be informed as to the circumstances under which colour is produced, and the means by which the sensation is conveyed to the mind. Connected with this is the question of the harmony or discord of colours, and the origin of the pleasure or dissatisfaction with which we view them. These are purely philosophical inquiries; but they form the foundation of a successful practice, and cannot be neglected by even those who have experience and an accurate and cultivated eye to guide them. The first part of this work has, therefore, been devoted to a consideration of these important questions; and although they have not been so fully examined as some of our readers might desire, they have, perhaps, been sufficiently illustrated to assist them in future investigations, and may be perused, if not studied, by those who would disregard a more profound examination.

In the second part of this work, we have endeavoured to explain the manufacture of colours, oils, and varnishes, and the tools employed by the house painter. An allusion to the science of chemistry could not be in this part avoided. It was not sufficient to state that in the admixture of two substances, a third is produced, and that the third is used as a pigment. Such barren information would be entirely destitute of interest to every person; the question would constantly present itself, Why is the effect produced, and to what agency can we trace the decomposition of the two substances, and the subsequent reunion of their component parts in the formation of new compounds? Of such knowledge the whole science of chemistry consists, and the force which

regulates all compositions is that of affinity ; so that the science itself is the doctrine of elective attractions. For the benefit of those who are unacquainted with the science on which the manufacture of pigments entirely depends, it has been found necessary to illustrate incidentally the doctrines to which we have alluded, and thus to prepare the mind of the reader for the statement of facts which would otherwise have been misunderstood. Whether the attempt has been successful or not, the reader will judge for himself; and he will be best able to decide, who has had no previous knowledge of chemistry.

An acquaintance with the philosophy of colours, and the manufacture of pigments, cannot be considered absolutely necessary to the house painter; for he may be able to cover a panel with paint, or to imitate the grain of a wood and the veins of a marble without a knowledge of either, but he will execute his work with less taste, and we might add, with less skill. The mechanical operations of house painting are described in the third part of this work; and the reader will there find many important hints derived from the experience of practical men, and the observation of the author, which will be most useful, if introduced in his own practice.

The book closes with a brief history of the art of painting. The author has, in this part of his work, attempted, as far as was possible, to confine his attention to house painting; but the history of the arts of design is so intimately connected with this subject, that it was found impossible to separate them entirely. The account which he has given is but a sketch, but it is also one which the reader himself may fill up by a perusal of the many important historical records and memoirs to which allusion has been made.

The author may be blamed by some of his readers for having spoken with what they may consider unnecessary severity of the want of information among house-painters as a class, upon all the subjects connected with their pursuits. It cannot, however, be denied that they are generally less informed than other artisans, although at the same time we acknowledge that there are individuals whose knowledge of their art, and taste in the practice of it, entitle them to the highest respect. These individuals, or at least many of them, have, during the last few years, shaken off their visible connexion with the class to which they belong, and have called themselves decorators. For a time this may separate them from the workmen whom they are evidently anxious to avoid, but a name cannot long be a protection to the educated classes from the invasion of the ignorant. It is more wise to instruct the uninformed than to separate them from the class to which they belong. The elements of the

knowledge they require, we have endeavoured to collect in this volume ; and if we have been severe in our animadversions upon those to whom our book is addressed, it has been to excite that desire for knowledge which has long acted beneficially among other artisans.

The prices paid for painters' work, and the mode of measuring it, are subjects which do not come under our consideration. The value of work must depend upon the manner in which it is done ; and much is it to be regretted that the surveyor does not make a more marked distinction than is customary ; as an adequate remuneration for superior work would have the effect of exciting the workman to the improvement of his art. The mode of measurement between the employer and the employed, is, perhaps, more fair than in many other departments of artificers' work ; but in all valuations of labour, the parties concerned greatly if not entirely depend upon the capabilities and judgment of the surveyor.

The author is not unconscious of the defects of this book, but at the same time he hopes that it will be found of some value to the art on which it treats ; and if it should in any degree aid its progress, by establishing in the minds of workmen the necessity of study and observation, his object will be attained, and his labour repaid.

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